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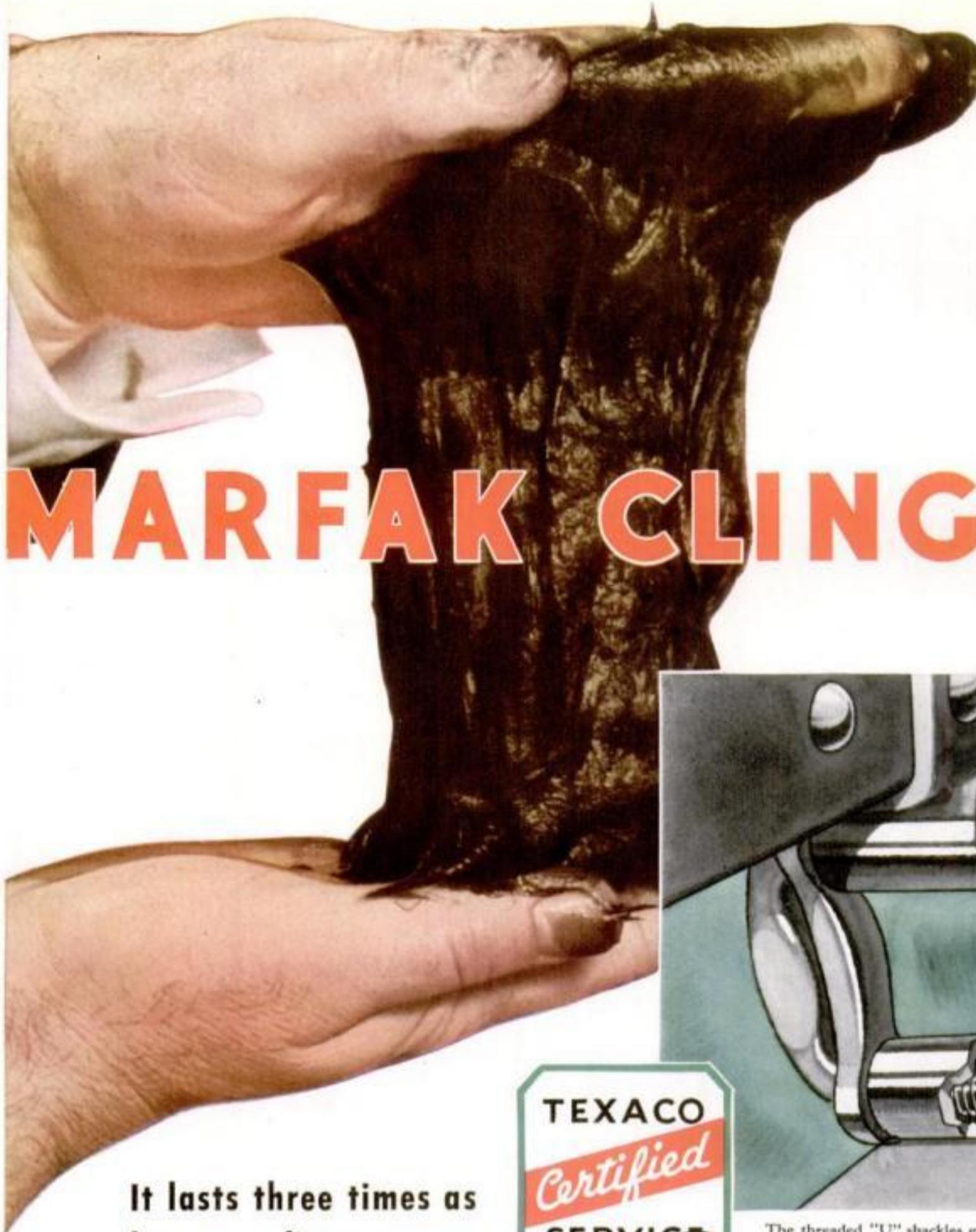


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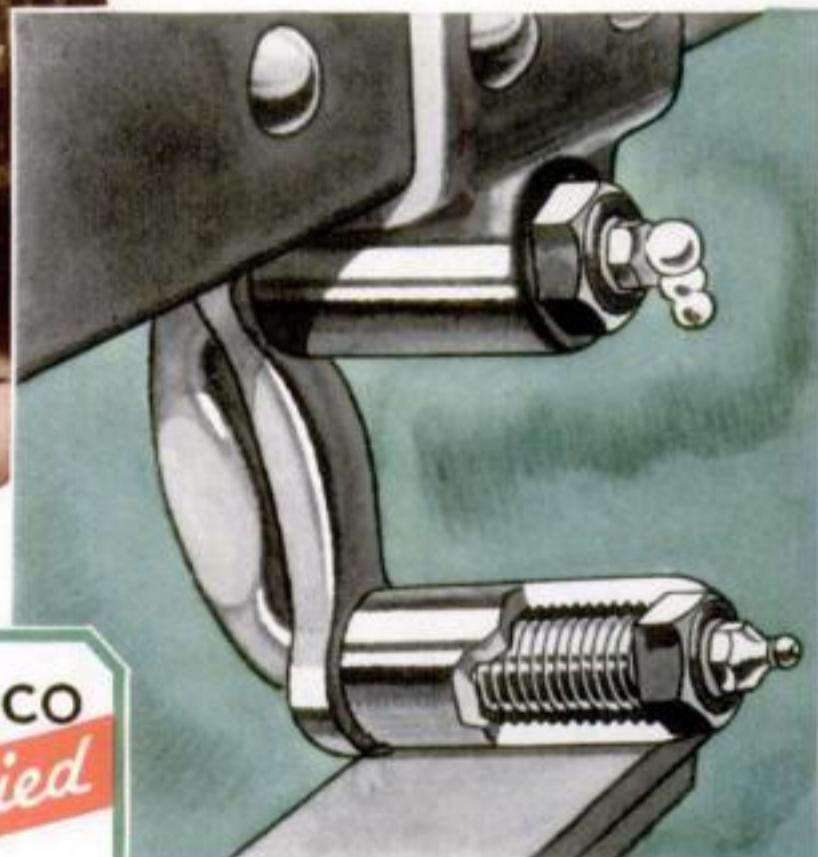


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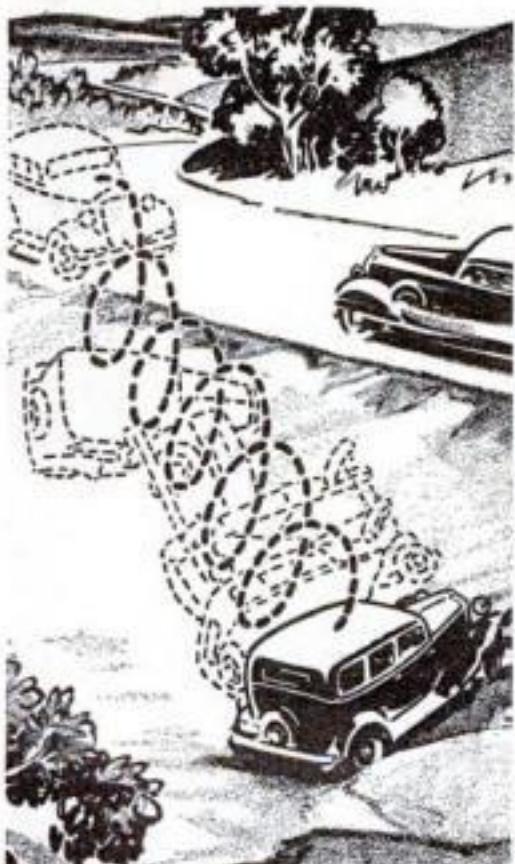


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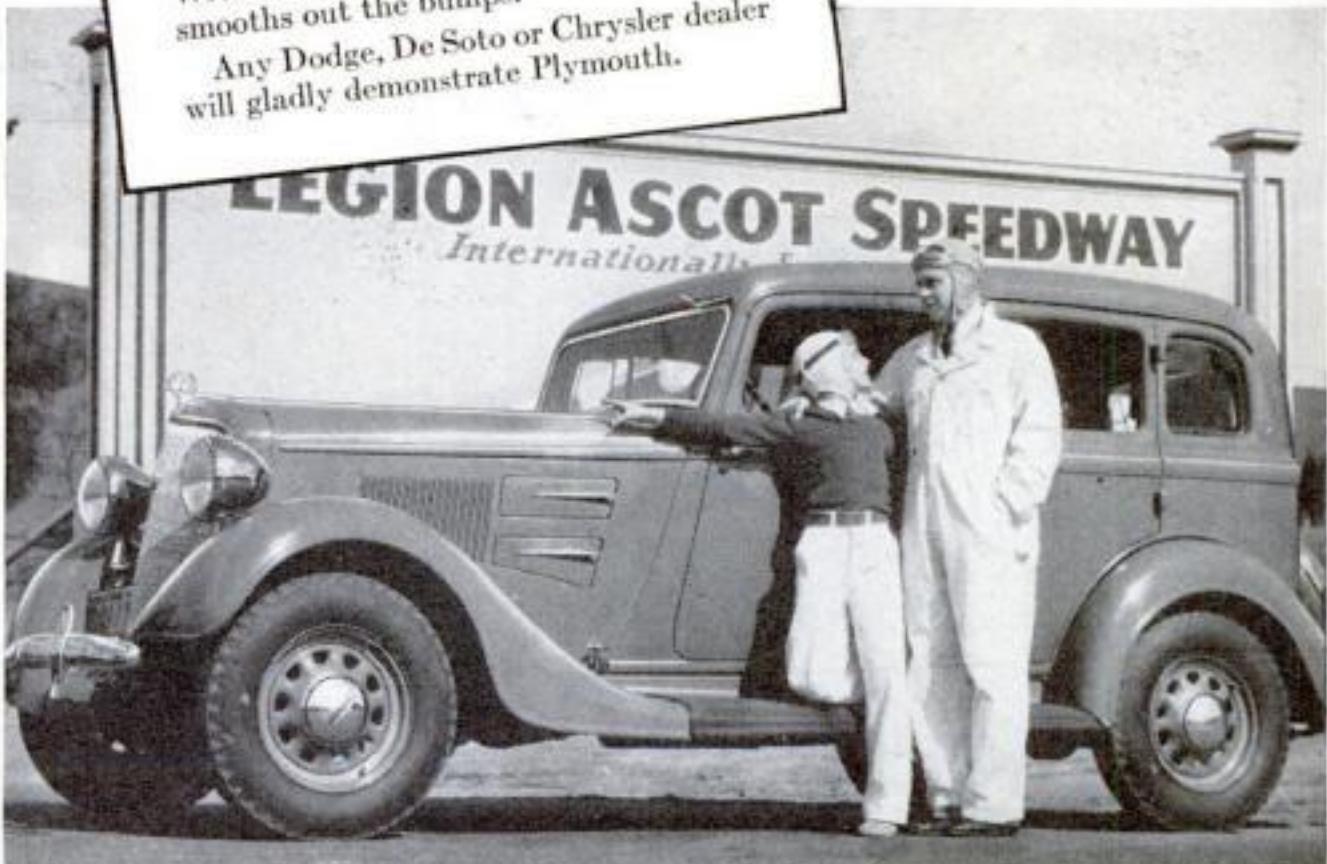
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# POPULAR SCIENCE

FOUNDED MONTHLY . . .

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## TABLE of CONTENTS for JUNE, 1934

### Giant New Telescope to Solve Secrets of Unseen Stars . . . . . 13

KENNETH M. SWEZEN shows what a 200-inch reflector may do for astronomers

### Freak Effects of Sound Revealed by New Tests . . . . . 16

Latest wonders of acoustics explained by EDWIN TEALE

### Human Faces Remodeled by Skilled Plastic Surgeons . . . . . 24

ANDREW R. BOONE tells how daring operations repair disfiguring wounds

### Strange Wild Creatures Tamed by Man as Pets . . . . . 32

THOMAS M. JOHNSON describes some queer choices in animal companions

### Voting By Radio . . . . . 36

First details of a startling new plan to register public opinion

### Experiments You Can Perform with a Homemade Spectroscope . . . . . 47

Simple tests, explained by GAYLORD JOHNSON, show how astronomers analyze stars

### Uncle Sam's New Treasure House for Gold . . . . . 49

An inside view with ARTHUR GRAHAME of a vault built to guard fabulous fortunes

### Electric Current Determines Sex . . . . . 58

What a startling new discovery may mean to stock breeders

June, 1934, Vol. 124, No. 6.  
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## FEATURES AND DEPARTMENTS

Termites Invade American Homes 6  
Microscope Wonders of Spring . . . . . 40  
Home Tests With Copper . . . . . 54  
Simple Rules for Healthy Trees 59  
New Ideas for Radio Handy Man 63  
One-Tube Short-Wave Set . . . . . 64  
Tuning Up Car for Summer Use 66  
The Home Workshop . . . . . 67  
The Month's Best Auto Ideas . . . . . 82  
How to Use a Miniature Camera 84

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## AUTOMOBILES

Meter Helps Park Car . . . . . 20  
Baby Drives His Own Car . . . . . 28  
Switch Opens Garage Doors . . . . . 30  
Headlights in Car Radiator . . . . . 34  
Gum Rubber Seals Punctures . . . . . 35  
Homemade Fire Engine . . . . . 45  
Periscope for Car Driver . . . . . 45

## AVIATION

Plane Lands on Rubber Balls . . . . . 21  
Build Air Liner Outdoors . . . . . 26  
Test New Safety Fuel . . . . . 28  
Fastest Commercial Plane . . . . . 29  
'Chute for Ambulance Plane . . . . . 30  
Plane Has Third Wing . . . . . 31  
New Umbrella Plane . . . . . 35  
Build Giant Flying Boat . . . . . 37  
Design Stratosphere Rocket . . . . . 42



# Keep Clean Shaven if you want to hold your job!

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WM. L. FLETCHER

"You can't fire me for that—not for a little stubble on my face!" . . . But he is fired for that. Neglect of personal appearance has cost him his job—and jobs are hard to get these days. Do you think that things like this don't happen—that this situation is overdrawn? We'll leave it to one who knows—Wm. L. Fletcher of Boston, recognized by authorities as one of America's greatest employment specialists.

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# POPULAR SCIENCE MONTHLY FOR JUNE, 1934

## MODELS

Learns Life Work from Models . . . . .	34
Model Shows Buried Lake . . . . .	43
Airplane Model on Pylon . . . . .	70
Foolproof Railway Switch . . . . .	81
Striping Ship Models . . . . .	81
Railway Signal Tower . . . . .	102

## NEW DEVICES FOR THE HOUSEHOLD

One-Handed Hanger . . . . .	56
Glasses Can't Tip Over . . . . .	56
Heater Like Blast Furnace . . . . .	56
Shovel for Hot Dishes . . . . .	56
New Food Masher . . . . .	56
Oven Thermometer . . . . .	56
Pie Plate and Frying Pan . . . . .	56
Lingerie Washer . . . . .	57
Three Pans in One . . . . .	57
Makes Your Steak Tender . . . . .	57
New Bed Chair . . . . .	57
Milk-Can Holder . . . . .	57
Smoker's Outfit . . . . .	57
Versatile Dutch Oven . . . . .	57
Home Intercommunicating System	57

## NEW PROCESSES AND INVENTIONS

New Armor for Police . . . . .	18
Tool for Mottling Walls . . . . .	18
Light Beams Guide Blind . . . . .	18
Tiny Bathroom Scales . . . . .	19
Midget Paper Punch . . . . .	20
Device Teaches Gymnastics . . . . .	23
Ten Garden Tools in One . . . . .	23
Thermometer for Grain . . . . .	23
Roller Spreads Shaving Cream . . . . .	23
Spectacles for Skiers . . . . .	28
Screwdriver Has Big Grip . . . . .	29
Shoe Controls Fire Hose . . . . .	30
Unsinkable Motor Boat . . . . .	31
Reads Books to Blind . . . . .	31
Instrument Finds Lost Radium . . . . .	35
Fish Lure from Abalone . . . . .	38
Rubber Flooring in Rolls . . . . .	38
Hinge Works by Gravity . . . . .	38
Silent Violin for Novice . . . . .	39
Machine Predicts Forest Fires . . . . .	39

New Paper Cup Has Handle . . . . .	39
Metal Paint Paddles . . . . .	42
Design Novel Oil Gun . . . . .	45
Sponge Made of Viscose . . . . .	45
Tool Opens Box Car Door . . . . .	46
Rake Has Adjustable Fingers . . . . .	46
Meter Measures Health Rays . . . . .	46

Rare Ambergris from Sea . . . . .	42
New Container for Cheese . . . . .	43
Sleds Carry Fish Nets . . . . .	43
Device Tests Silk Stockings . . . . .	43
Giant Figure Serves as Ad . . . . .	44
New Rig for Sailboat . . . . .	44
Derrick Travels on Wheels . . . . .	44
World's Biggest Thermometer . . . . .	45
Gold from Worthless Dirt . . . . .	45
Air Vent for Speedboat . . . . .	46
New Poison Gas Treatment . . . . .	46
Nature Makes Things Six-Sided	53

## PHOTOGRAPHY

Camera Takes Tiny Photos . . . . .	22
Focuses Camera in Dark . . . . .	31
Photographer on Sea Floor . . . . .	38
Contest Prize Winners . . . . .	80

## RADIO

Radio Hams Save Flooded Area	19
Receiver for Car or Home . . . . .	20
Radio Power to Run Rail Car . . . . .	21
Police Carry Broadcast Sets . . . . .	22
Pupils Build School Radio . . . . .	34
Radio Used on Train . . . . .	43

## UNUSUAL FACTS AND IDEAS

Golf Balls Get "Shot in Arm" . . . . .	18
Talking Robot Greets Visitors . . . . .	19
Mast Trains Sailors Ashore . . . . .	19
Biggest Elevator for Ships . . . . .	20
Cash for Dead Ants . . . . .	20
Find How Lightning Travels . . . . .	21
Invents Strange Machine Gun . . . . .	21
Test Shocks on Human Beings . . . . .	22
Wand Tests Bird Knowledge . . . . .	23
Gave Cities of Tomorrow . . . . .	27
Hobby Makes Him Arrow Expert . . . . .	28
New and Old in Trains . . . . .	28
Lamp Bulbs Get Odd Shapes . . . . .	29
Swimming Taught by 'Phone . . . . .	29
Builds Home Like Barrel . . . . .	29
Skyscraper Encased in Bamboo . . . . .	30
Synthetic Church Bell . . . . .	30
Public Call Box Brings Aid . . . . .	34
Growing Ivy Decorates Room . . . . .	35
Skeletons Show Man's Ascent . . . . .	35
Imaginary Court Teaches Tennis . . . . .	38
Test Torpedo in Wind Tunnel . . . . .	39
Rustproofing Warship's Shafts . . . . .	39
New Mail Addressing Plan . . . . .	42

Skyscraper Smoking Stand . . . . .	68
Jig-Sawed Metal Work . . . . .	68
Sawed-Out Chinese Lamp . . . . .	70
Ornamenting Metal Tubing . . . . .	74

## WOODWORKING

Boy's Boat Built for \$5 . . . . .	67
Porch Lounging Chair . . . . .	79
Home Workshop Blueprints . . . . .	90
Our Construction Kits . . . . .	92
Turned-Column Mirror Frame . . . . .	94

## IDEAS FOR THE HANDY MAN

Scribing Center Lines . . . . .	68
Homemade Casting Rod . . . . .	69
Small Microscope Projector . . . . .	70
Homeworkshop Guild News . . . . .	71
Jig-Sawed Place Cards . . . . .	72
Plating with Old Hypo . . . . .	72
Covered Kitchen Chair . . . . .	72
An Outdoor Roaster . . . . .	72
A Family Swimming Pool . . . . .	73
Magic with Knives . . . . .	75
Corner Joints for Thin Stock . . . . .	76
Keeping Small Boats Shipshape . . . . .	77
Old Bill Says— . . . . .	79
Removing Bushing from Hole . . . . .	79
Transformer for Door Chimes . . . . .	80
Gages Aids in Sawing . . . . .	81
Uses for Old Felt Hat . . . . .	88
Hose Hung on Candy Pail . . . . .	91
Refinishing Rusty Hardware . . . . .	91
Advanced Microscope Unit . . . . .	101
Heatproof Grip for Pliers . . . . .	101

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P.S. M. 58

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*Motorists Wise*  
**SIMONIZ**  
Keeps Cars Beautiful



Scraping away tiny tunnels excavated by termites under frame house. Glass bricks will stop the destructive pests.

## Wood-Eating Termites NOW RAVAGE AMERICA

By  
R. M.  
B O L E N  
*Secretary,  
Popular Science Institute*

**T**HROUGH a diet of dead wood, an army of antlike insects called termites is costing American home owners more than \$30,000,000 every year. Once common only in the tropics, they now have invaded almost every section of the United States, devouring all manner of wood from telegraph poles to grand pianos. Even a modern theater in the crowded heart of New York City has proved a choice item on their bill of fare. Not long ago, a housewife was seated at the breakfast table. Suddenly, as she reached for her cup of coffee, the table swayed and crashed to the floor, its legs literally hollowed out by "white ants."

In another instance, two real estate agents were inspecting a large southern hotel that had been closed for several months. A peculiar looking finish on the floor of the ball room interested them. On closer inspection, the varnished surface proved to be thin as paper. Almost the entire hardwood floor had been consumed by termites.

Although forty-six species of termites (sometimes erroneously referred to as "white ants") are known to exist in this country, entomologists place the blame for most of the damage on the subterranean branch of the family. Living in well-organized nests, or termitaries, below the ground, they bore ingenious honeycombs

of galleries and far-reaching tunnels to aid them in their destructive work. Heading each nest are a king and queen who breed the millions of workers, soldiers, and reproductive swarmers. Operating like thieves, silently and in the dark, the termite workers, small, blind, and sexless, are seldom seen and give no warning of their presence until a floor gives way or a chair collapses.

The winged members are the advance guard of the insect army. Swarming from their nest when full grown, they lose their wings and bore deep into the ground to form new colonies as ruling kings and queens. Once the nest has been established, it is a question of time only until thousands of ravenous workers are gnawing at the baseboards, timbers, and beams of some near-by house. The soldiers, with their pincerlike jaws, protect the workers against their natural enemies, the ants.

Even concrete or brick foundation walls prove no obstacle to these termite workers. Shunning the light and dry air, they span the concrete by building tiny vine-like tunnels that resemble harmless streaks of hardened mud. Dozens of these tubes often can be found spreading over a few square feet of cellar wall like the veins and arteries in the back of your hand.

As unique as the termite's mode of living is its extraordinary method of

digestion. Although they live almost entirely on wood, they cannot digest it. This portion of their work is done for them by microscopic one-celled creatures called protozoa that inhabit the termite's intestinal tract.

The first warning of the termite's invasion of the United States came when a public library in Pasadena, Calif., was attacked in 1926. Since then builders, chemists, and government scientists have been devising means to combat the termite.

To date two general methods of termite control have been advanced. The first is to cut off the termites' food supply. To do this, it is necessary first, of course, to remove all means of communication between the ground and the wood of the building. Cut off from his nest and a supply of moisture, the termite lives only a short time. Then changes in construction can be made to protect the wood surfaces. Metal termite shields can be installed to prevent the worker from reaching his goal.

One of the latest contributions to the weapons of termite control are glass bricks. It is claimed that used to form the top of a foundation wall they prevent the termite from building his communicating tunnels to the wood above.

The second method of defeating the termites in infested structures is to enlist the services of some reputable termite-control company. Their experts armed with chemicals compounded according to special formulas guarantee five years of relief once they have treated a building.

Obviously, the best way to combat the termite is to construct termite-proof buildings. If you are planning a house or are having one built, make sure your contractor takes every possible precaution against a termite invasion. Be sure the ground beneath the house is cleaned of tree stumps, wood chips, and other rubbish. Take precautions to avoid dampness and poor ventilation and insist that a treated wood be used in the understructure close to the ground. If your house is to have a cellar, provide a carefully laid, crack-proof floor and make sure that all foundation forms are removed when the work is completed.

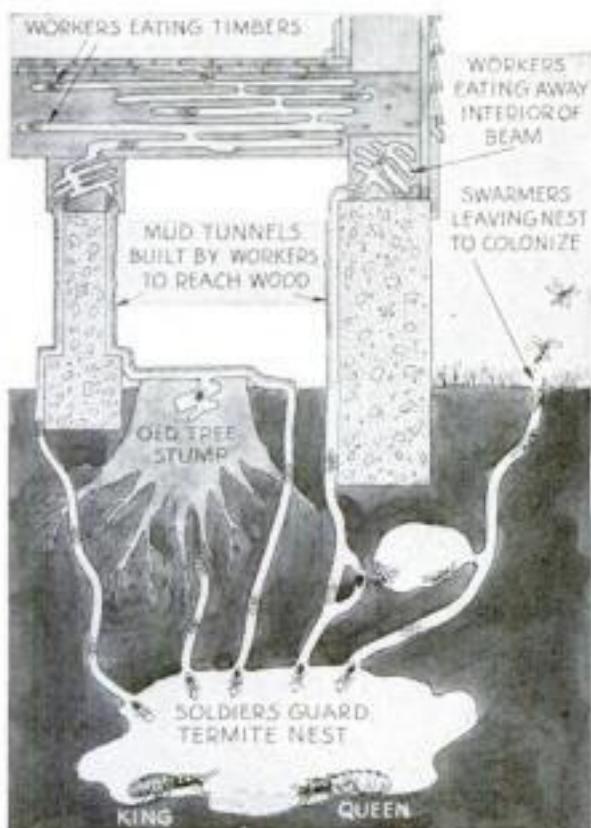


Illustration shows how termites dig tunnels to reach wood and then eat it from the inside



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*The standard 1 year warranty, PLUS 4 years ADDITIONAL protection on this famous sealed-in-steel mechanism for only \$5 . . . a dollar a year!*

THE G-E MONITOR TOP . . . first electric refrigerator to carry a 2 year guarantee, first to give a 3 year guarantee, and first to give a 4 year service plan . . . now gives 5 years protection on its famous sealed-in-steel mechanism for only \$5 . . . a dollar a year.

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# Our Readers Say



## Whether He's Coming or Going Would Be Hard to Tell

PERHAPS some reader can explain what would happen in this situation: Suppose it were possible for a man to leave the earth in a rocket and travel to a planet, say one light year's distance from the earth. Also suppose it were possible for this rocket to travel at twice the speed of light. This is a bit of a tall order, but just suppose it. On arrival on the distant planet our traveler finds a super-telescope conveniently set up near his landing place. Turning the telescope in the direction whence he came, what would he see? Would he see himself coming or going? Would he see himself on the earth he had left six months before? He would, in traveling, have passed light that left the earth before he did. For how long would he see himself and how would the picture end? Would it finish by running right up to him and hitting him in the eye? Would like to get this cleared up before they come for me with the wagon.—V.M.B., New York, N. Y.



## Oldest Reader Has Complete File of Popular Science

SEVERAL months ago in the section Our Readers Say I noticed where a man had found, in his attic, the first issue of the POPULAR SCIENCE MONTHLY. Well, I know a preacher of Charlevoix, Mich., who has taken your magazine every since he was a boy. He has saved them and he says he has every issue ever since the magazine was first printed. A year or so ago you ran a series of articles on crime detection. They were very interesting. Why don't you start a new series along this line or on something similar and keep us all interested?—R. G., Clare, Mich.

## Christmas-Tree Lights On Cars May Soon Be Commonplace

A BILL is being sponsored by a state senator here requiring every motorist to have red lamps installed on his dashboard and license plates which would light up if he exceeded the speed limit. Thus, both he and the police would know he was breaking the law. But, why stop here? Why not have a blue light go on if you run through a traffic signal; a green light if you make a wrong turn; a purple light if you park near a hydrant? Probably, human nature being what it is, the first result would be a new outdoor sport—seeing who could accumulate the most lights in a given time. Having your car lit up like a Christmas tree probably would soon be considered an honor and something to be proud of.—A. O., Brooklyn, N. Y.



## Speed of a Bullet Starts Argument in Santiago

I HAVE been discussing with several friends the following subject: They say that according to ballistic laws a bullet fired from a gun attains its greatest velocity when it has completed about half of its trajectory. I maintain that a bullet attains its greatest velocity of speed in the barrel of the gun. I base my opinion on the fact that after a bullet leaves the gun's barrel it meets obstacles to its movement through space and receives no force from any source to drive it on. If any reader of POPULAR SCIENCE MONTHLY can show me I am wrong, I will be much obliged.—G.S.P., Santiago, D. R.

## After Reading This Letter Is Glasgow's Face Red?

THE attack on the Our Readers Say cartoonist by I. McD. of Glasgow was most foolish. He gets all het up because a Scotman is depicted as wearing kilts. Suppose Americans wrote such letters to every foreign publication that published a cartoon showing an American as a vicious-looking person who is carrying a smoking gun in one hand and a kidnaped child in the other! The mails would be unable to carry them all. I think that the Our Readers Say cartoons are among the most original and amusing I have ever seen. I would like to grab your cartoonist by the hand and say, "Boy, your stuff is grand." And now if R.D. Jr. of Chicago will open his ear a little wider, I will answer his questions. Yes, space was born. There is life on some of the other planets, but not on all of them. Matter was created by a magician who said, "Offy doof," and there matter was. Space is not endless. It ends about two billion miles from the earth. The people that should be saved in the event of the ending of the world should be the editor of POPULAR SCIENCE MONTHLY, the cartoonist of Our Readers Say, and myself. Now, Junior, run out and play because I'm sure I don't know why we are and as far as I know no one, outside of religion, has ever given a reasonable explanation of our existence, or where we are going if at all.—C.F.J., Jr., Lynchburg, Va.

## Water in Whirling Pan Used to Illustrate Law of Rotation

THE proper answer to E. M., of Newport, Wash., who inquired as to the laws governing rotating objects, is, in my opinion, as follows: Hydraulics engineers have discovered that when a pan of water is rotated, the surface of the water will rise on the outside and dip in the middle to form a perfect parabola. The farther away from the center we get the higher will be the rotating mass. If we rotate the vessel fast enough, a dry spot will

appear at the center but the surface will still be the top part of a parabola.—J.J.T., Shadyside, Ohio.

## From Turbulent Cuba Comes Request for a Star Map

LIKE J.F.W., Pittsfield, Mass., I should like to see plans for a homemade seismograph. Two years ago we suffered a severe earthquake which partly destroyed our city. Since then we have experienced over 150 temblors of different intensities. The curious fact is that people always think that the last one felt has been the most intense. This is absolutely wrong, since all depends on the location, position, and nervousness of the person at that moment. With a seismograph there would be no chance for an argument. Another request: Why not publish a blackboard map of the sky such as the one published last summer and introduce to us the constellations that brilliantly adorn our winter nights? Capricornus, Sagittarius, Scorpio, Libra, Virgo, have moved away, but others as beautiful have taken their place. Last month Venus, as an evening star, was seen as big as a coconut, if a coconut is an appropriate comparison. Winter nights in Cuba furnish spectacular sights.—R.Q., Santiago, Cuba.



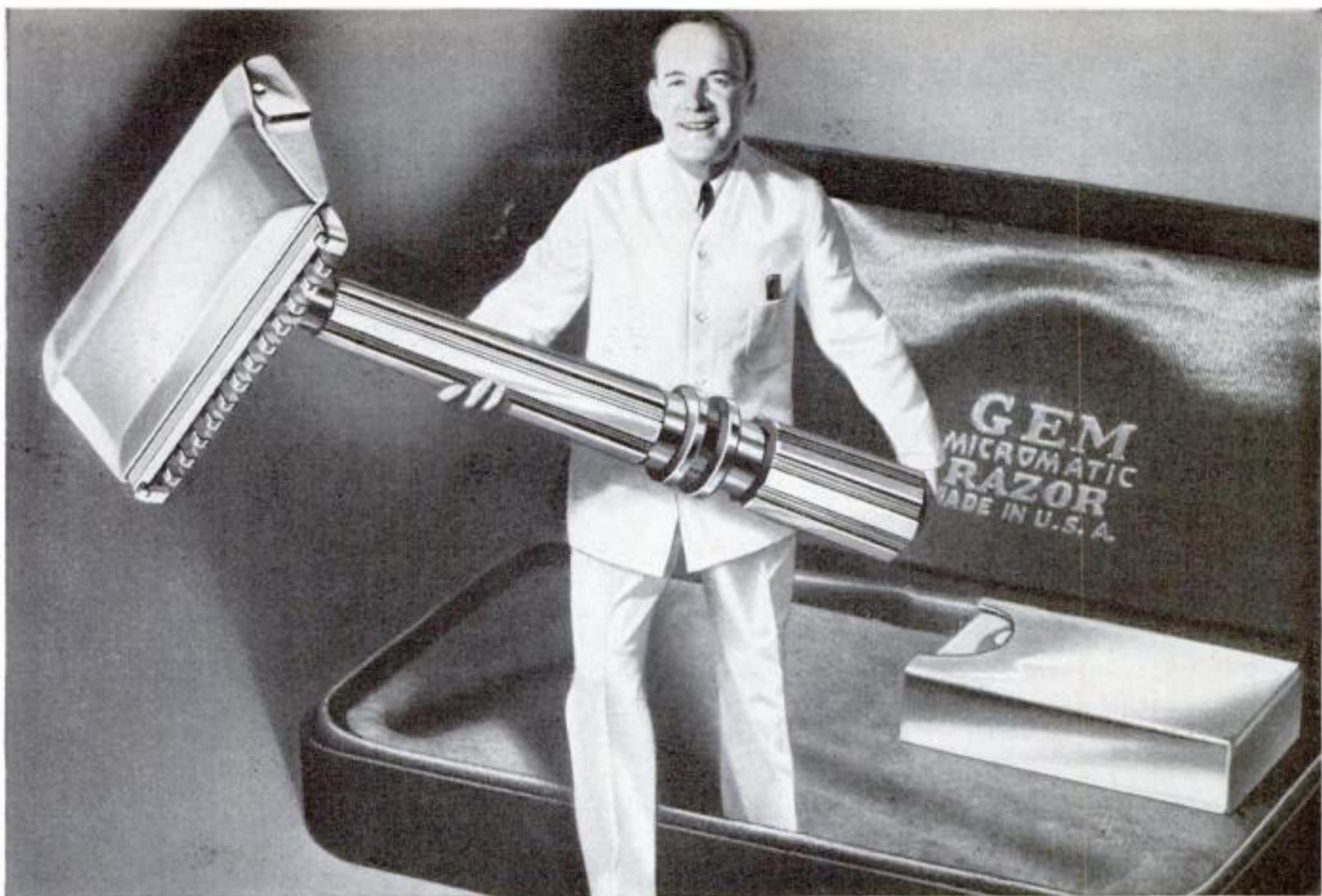
## Turn to the Radio Section And You'll Be Surprised

IN READING a recent issue of POPULAR SCIENCE MONTHLY I noticed a letter from E.T.H., Jr., Watonga, Okla., asking you to print more on one-tube sets. I am for this in a big way. I think this would be very good for beginners in radio.—D.Y., Utica, N. Y.

## High-Flying Reader Wants Low-Down on Air Pictures

WITH so many people flying these days, there must be many among your readers who, like myself, have attempted photography from the air—with rather disappointing results. Your publication has given its readers many good articles on aviation written by competent men and I believe one on the art of taking air pictures would be well received. Naturally no professional is going to give away hard-earned knowledge but he surely would be willing to give general advice as to the right type of film to use, the correct exposure, the proper filter, and the best method of preparing a camera for air work, especially if it is to be





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PRINT NAME.....

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# GEM MICROMATIC Razor and Blades

used from an open plane. Personally I should find such an article of great interest and, probably, many others would share my view.—O.S., Porto Alegre, Brazil.

## Just the Same, If You Don't Mind, We'll Keep Out of the Way

HERE'S one for some amateur Einstein to try and find the catch in: By simple and logical reasoning it is easy to show that it is impossible for a bullet to move. Don't believe it? Well, you'll admit that a bullet cannot move so long as it remains where it is. Think that over! Right, isn't it? Now, a bullet cannot possibly move, or do anything else, where it is not, can it? So the only possible conclusion is that since a bullet cannot move where it is, and cannot move where it is not, a bullet cannot move at all. I'm told that this is a classical old brain-teaser in modern dress and that it was originally known as Zeno's Paradox, after the philosopher who first propounded it—C.O.S., Pasadena, Calif.



## Wasting Gasoline Gives This Baltimore Reader a Shock

I READ recently that a group of automotive engineers had found that only about twenty percent of the actual energy in gasoline is converted into work. Why not spend a little more time trying to increase efficiency instead of decreasing air resistance? You can't save something you haven't got but it seems to me that eighty percent of the cost of every gallon of gasoline a car uses is an important factor as far as running expense goes.—J.K., Baltimore, Md.

## Here's a Pertinent Question About Airplane Propellers

I HAVE just finished reading Edmund T. Allen's article on "Breath-Taking Stunts Test New Transport Planes." I hope you will have more of the same kind. The following question happened to force itself on me while I was reading that article, and I wish one of your aeronautically minded readers would answer it for me. What part of the propellers produces the most noise, the part near the hub or the tips, and why? If you added articles on crime detection and surgery your magazine would be absolutely complete.—R.J.G., Buffalo, N. Y.

## What a Sense of Smell the Far-Seeing Eagle Must Have!

RECENTLY I read somewhere that certain odors increase the ability to see clearly. What connection there is between the nose and eyes is more than I can see, or smell, but if there's any worth to the idea it seems to me that it has unlimited possibilities. Why not equip all gunners in the army and navy with a bottle of just the right perfume and thus improve the accuracy of their marksmanship? Or perhaps flavor the air in motion—picture houses, musical-comedy theaters, and night clubs to reduce eye strain? Tell me, is there anything to this business or is it just so much bunk like the old idea that closing your eyes made you hear better?—L.K.V., Easton, Pa.



## When Sugar Hits Boiling Water Steam Causes Noise

IN A recent issue of POPULAR SCIENCE MONTHLY, J. C. B., of Phoenix, Ariz., asked why sugar poured into boiling water makes a noise while it makes no noise when poured into lukewarm water. He is correct in his statement as to noise and no noise. But sugar is not the only thing that will produce a noise. Table salt also makes a noise and probably any granular material would do the same, not including the chemicals that produce a sizzling noise even in cold water. The noise is produced by the formation of steam caused by the sharp edges of the crystals. If the water is just at boiling point and is kept there by a flame, this experiment would produce a small explosion and the water would boil overboard.—M. M. L., Belleville, N. J.

## Life, Space, and Collision Problems All Solved with Dispatch

R. D. JR., of Chicago, asked in a recent issue of POPULAR SCIENCE MONTHLY some rather difficult questions that have not as yet been satisfactorily answered. As we all know, Mars and Venus have been picked by many as favorable for life. The arguments are based upon the fact that the temperature of Mars sometimes climbs as high as sixty degrees, Fahrenheit, in the daytime, and that Venus has carbon dioxide in her atmosphere. Although most scientists are skeptical about the possibility of life on Mars, they think that vegetable life could exist on Venus. R. D. Jr.'s third question is another hard one, but theories have been advanced that state that matter was first created by energy; that a continual changing of matter into energy, and energy into matter, will forever happen. Is space endless? is his next question. Yes and no. Einstein leads us to believe that the universe is finite yet unbounded. Some say that the universe, ever since its birth, has been constantly expanding, and this may account for its immensity. Now for the last question which is easy: the popular notion that the earth would be destroyed by collision with a comet is not logical. It must be remembered that the nucleus of a comet is not as dense as it appears to be, but seems to be composed of swarms of small particles enveloped in a gaseous head. Therefore, if the earth should pass through the head of a comet, as it would surely do, instead of colliding, a meteoric shower of great beauty would undoubtedly be the result.—W.B.J., New Castle, Del.



## No Science in Collecting Stamps, Says Collector

IN A recent issue of your magazine, A. P. Jr., of Bloomfield, N. J., asked for a stamp page in POPULAR SCIENCE MONTHLY. I am a stamp collector but I do not favor a stamp page in your publication. Issuing and collecting stamps has nothing to do with science.—F.H.S., Bangor, Me.

## Just Try This Snow Test On Your Squeezing Machine

THE molecular theory of gases says that the molecules of a gas move closer to each other as the temperature falls. Still, scientists claim that snow can not be condensed from air which is too cold. If rain is squeezed out by air molecules, why couldn't snow particles be condensed, even at sub-zero temperatures, if the relative humidity of the air reached

100 percent? I can see no reason for such no snow predictions. Please, weather prophets, explain yourself.—C.D.S., Pine Hall, N. C.

## Give This Little Girl Some Great Big Fingerprints!

I'M NOT kicking about what you do or don't have, but I do wish you'd publish something about what women have done and are doing in police work. Also the best way to get into this work and especially something about fingerprinting. I agree with R. A., whose list of favorite articles published last year appeared in a recent issue of POPULAR SCIENCE MONTHLY. Especially I agree with him about the aviation and police articles. Everybody is, or should be, interested in what the police are doing to insure our safety. As for aviation, it has done more for the whole world than anything since the first flying machine was launched. Hurrah for POPULAR SCIENCE! How about some articles on traveling on a motor cycle?—(Miss) R.J.B., Howell, Mich.



## If They Are Workers, Why of Course, They're Females

E. C. B. of Sioux City, Iowa, says I am "dumb on the problem of sex in bees" and suggests that if I will "do a little intensive studying I will find that, through some paradox of nature, the worker bees have no sex, and are neither male nor female, but are termed neuters." The A B C and X Y Z of Bee Culture, a recognized authority for nearly seventy years on all bee matters, states: "The workers, instead of being neuters, are all females." Weedon's Modern Encyclopedia says: "workers themselves are females and can lay eggs." International Encyclopedia describes workers as "females whose generative organs are undeveloped; they are therefore erroneously called neuters." Can it be possible that these authorities are "dumb" (like me)? Worker bees lay eggs, under certain conditions, but the eggs, being infertile, always hatch drones. The unmated queen also lays infertile eggs. The neuter idea was exploded years ago. I have found but one book, published more than a hundred years ago, that calls the worker bees neuters. Is it possible E.C.B. is many years behind the times? Try a little of your "intensive studying," E.C.B., and come up to date.—C.H.P., Canaan, Conn.

## All Good Things Come to Those Who Keep Their Eyes Open

HURRAH! It's happened at last. Just what I've been watching and waiting for! I mean the article on artificial marble novelties published in a recent issue of POPULAR SCIENCE MONTHLY. Man, I've been buying your magazine issue after issue hoping something like this would happen. I had just about given up hope and then there it was exactly as I wanted it to be. Give us some more on artificial marble, colored concrete, and plaster. There are a lot of us fellows who would gobble up such articles as eagerly as some of the others do wood working, model making, and other things of the like nature.—A.D., Clarendon, Texas.





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IS YOUR HAIR difficult to keep in place? Does it lack natural gloss and lustre?

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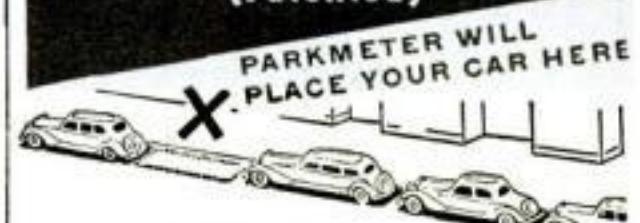
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## MAKES IT EASY TO PARK ANY CAR AT THE CURB

With this uncanny, yet simple, parking guide mounted on the dash you back into that just-big-enough parking space at the curb accurately and easily.

1.

Stop opposite rear of the forward car and engage the Parkmeter.



2.

Drive straight forward until indicator points to red arrow.



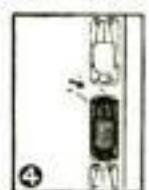
3.

Cut wheels to right, back up until indicator points to white arrow.



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This seemingly impossible instrument is simply a measuring device far more dependable than the most expert motorist's eye. It tells you the exact moment for each operation—assuring perfect parking every time.

Parkmeter fits every car—a handsome addition to the dash—no holes to drill—no difficult installation. It is a finely made reliable instrument, guaranteed by one of the oldest automotive equipment concerns in the country. Your dealer can equip your car with Parkmeter or you can obtain an instrument direct with complete instructions for installation.

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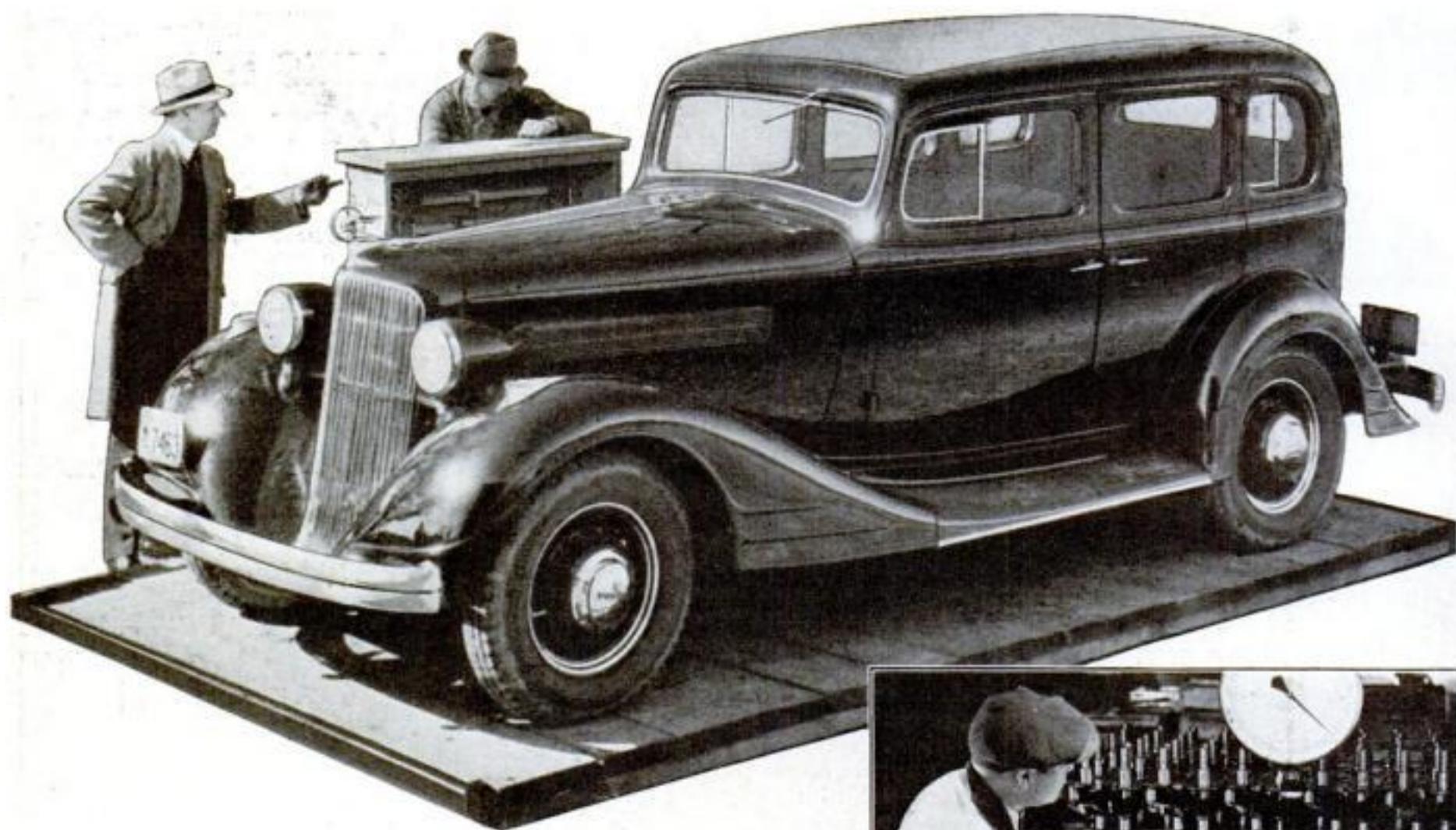
Enclosed find \$7.50. Send me postpaid one Parkmeter, with complete instructions for installation. My car is a \_\_\_\_\_ (year) \_\_\_\_\_ (model) \_\_\_\_\_ (make)

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

# Pontiac's Extra Weight

## PROVIDES GREATER SAFETY AND DEPENDABILITY



### PROVING AGAIN THAT QUALITY MEANS MORE THAN PRICE . . .

It is through no accident of engineering that a Pontiac Straight Eight weighs from 200 to 700 pounds more than any of its principal competitors. That extra weight was skillfully planned and deliberately provided to give Pontiac owners greater safety . . . comfort . . . roadability . . . and longer car life. Yes—and to protect their investment.

• • •  
Perhaps Pontiac could—in the interests of a lower first price—cut down on the weight of the car. Perhaps Pontiac could get its remarkable gas economy by trimming weight here and there throughout the chassis, instead of by advanced motor engineering and precision manufacturing.

To reduce weight in this way might not make the car entirely unsafe, because Pontiac parts are mostly *oversized*. But it would certainly shorten the life of the car, and that would mean that the buyer would

be money out in the end. So Pontiac prefers to achieve gas economy through such advanced motor features as its new G.M.R. cylinder head . . . vacuumatic spark control . . . the most efficient cooling system in the industry . . . its new mixture heater . . . full pressure, metered-flow lubrication . . . and a dozen others. Pontiac prefers to build its chassis and its body for the years—for that means long and trouble-free life.

#### Remarkable Operating Economy

Pontiac's operating economy is truly remarkable, judged by any



*Pontiac fenders are shaped from heavy sheet steel and weigh considerably more than those used on the average car in the low-price field. Pontiac builds for long life.*



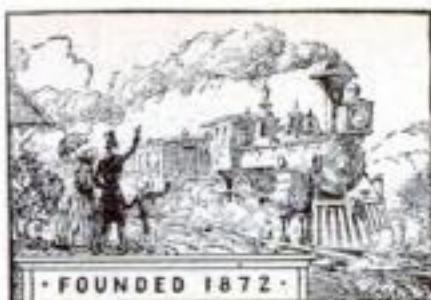
*The big, sturdy Pontiac crankshaft of chrome-nickel alloy steel weighs 71 pounds—one example of the strength and reliability that Pontiac builds into all its cars.*

standards. Many owners say they get 15 to 18 miles to the gallon of gas . . . 600 miles to the quart of oil . . . a whole winter's use on one filling of anti-freeze.

The new Pontiac, with its advanced Straight Eight engine, its enclosed Knee-Action wheels, its luxurious Fisher bodies and its *extra weight*, is as *smooth* and *easy riding* as any car you can name, *regardless of price*. Why not give your family the advantages of distinguished Pontiac transportation? See your nearest dealer.

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Illustrated, the 4-door Sedan, list price at Pontiac, Michigan, \$805. List price of other models at Pontiac, Michigan, \$715 and up. With bumpers, spare tire, metal tire cover, tire lock and spring covers, the list price is \$32.00 additional. PONTIAC MOTOR CO., PONTIAC, MICH.



# POPULAR SCIENCE MONTHLY

June 1934

Vol. 124, No. 6

RAYMOND J. BROWN, Editor



# Giant New Telescope

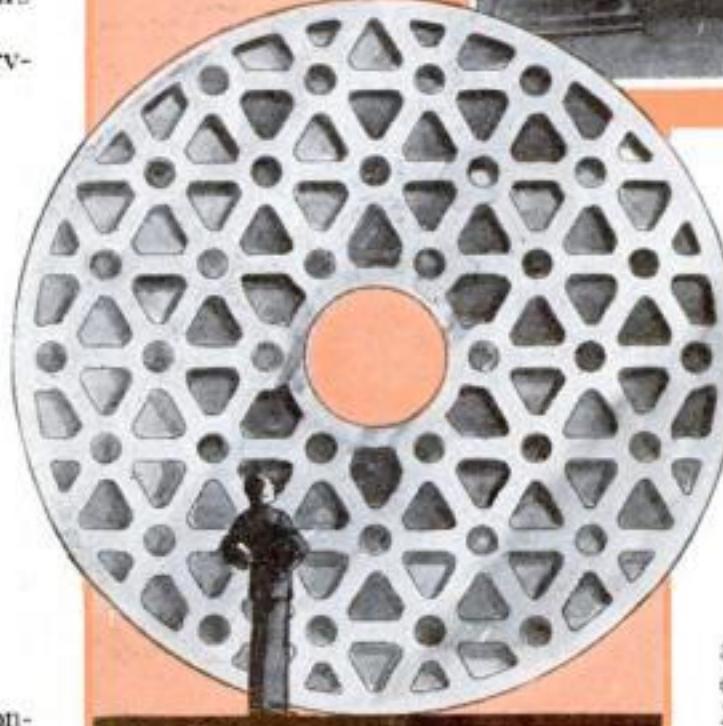
TO SOLVE SECRETS  
OF UNSEEN STARS

WITH the pouring of a 200-inch disk of glass, the other day, the world's largest telescope has been brought a big step nearer completion. The new instrument will have a light-gathering power two million times that of the human eye and will be able to see across a billion light years of space.

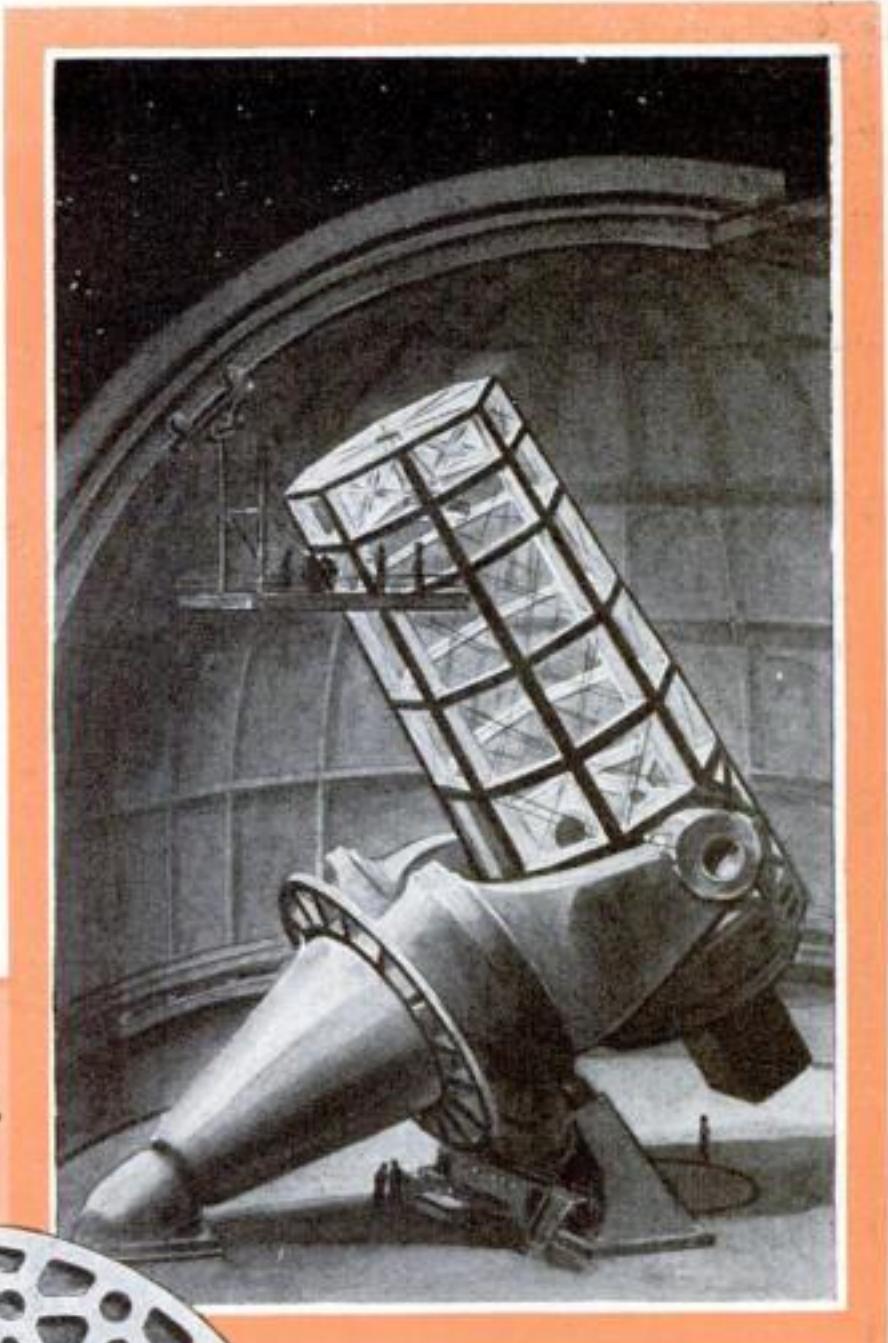
Costing \$6,000,000, including an observatory building and laboratory, the new telescope is being built for the California Institute of Technology, and will be erected on a mountain top near Pasadena. Ten times more powerful than any telescope now in use, this greatest and most expensive scientific instrument ever built is expected to open up thirty times the volume of space hitherto known, reveal millions of new stars and star clusters, and help solve some of the most baffling problems of the universe, problems that have puzzled astronomers for centuries.

Because it is practically impossible, and certainly too costly, to make a telescope containing a spyglass lens larger than forty inches across, the largest telescopes depend upon great concave mirrors to collect the rays coming from distant stars and to focus them upon an eyepiece or photographic plate near the top of the huge tube of the instrument. Usually they are made of glass, sometimes of metal, and the surface is ground and polished to an accuracy of within two millionths of an inch. The vital eye of the reflecting telescope must also be virtually unaffected by even sud-

By  
Kenneth M.  
Swezey



*Giant instrument, with 200-inch mirror, making it ten times as powerful as biggest now in use, will reveal the remote nebulæ hitherto invisible from earth*



Above, illustration showing how gigantic telescope will look when completed. Human figures suggest its size. At left, rear view of the big mirror with a man standing in front to give idea of the proportions of this enormous glass disk.

den changes in the temperature.

The production of flawless disks of glass for such mirrors has taxed the utmost abilities of glass makers both here and abroad. The disk of a sixty-inch mirror must be eight inches thick and weigh a ton. The 100-inch mirror of the Hooker telescope, at Mount Wilson, California, is thirteen inches thick and weighs nearly five tons. It is the largest in the world. The glass disk for the 200-inch mirror is nearly thirty inches thick and weighs approximately twenty tons. It is four times larger than the biggest mass of glass hitherto poured into a single mold.

For nearly six years, experts studied the problem of casting the gigantic disk. They experimented with fused quartz; but quartz proved too intractable for such a large mirror. Then came the idea of glass disks built up in segments with the edges

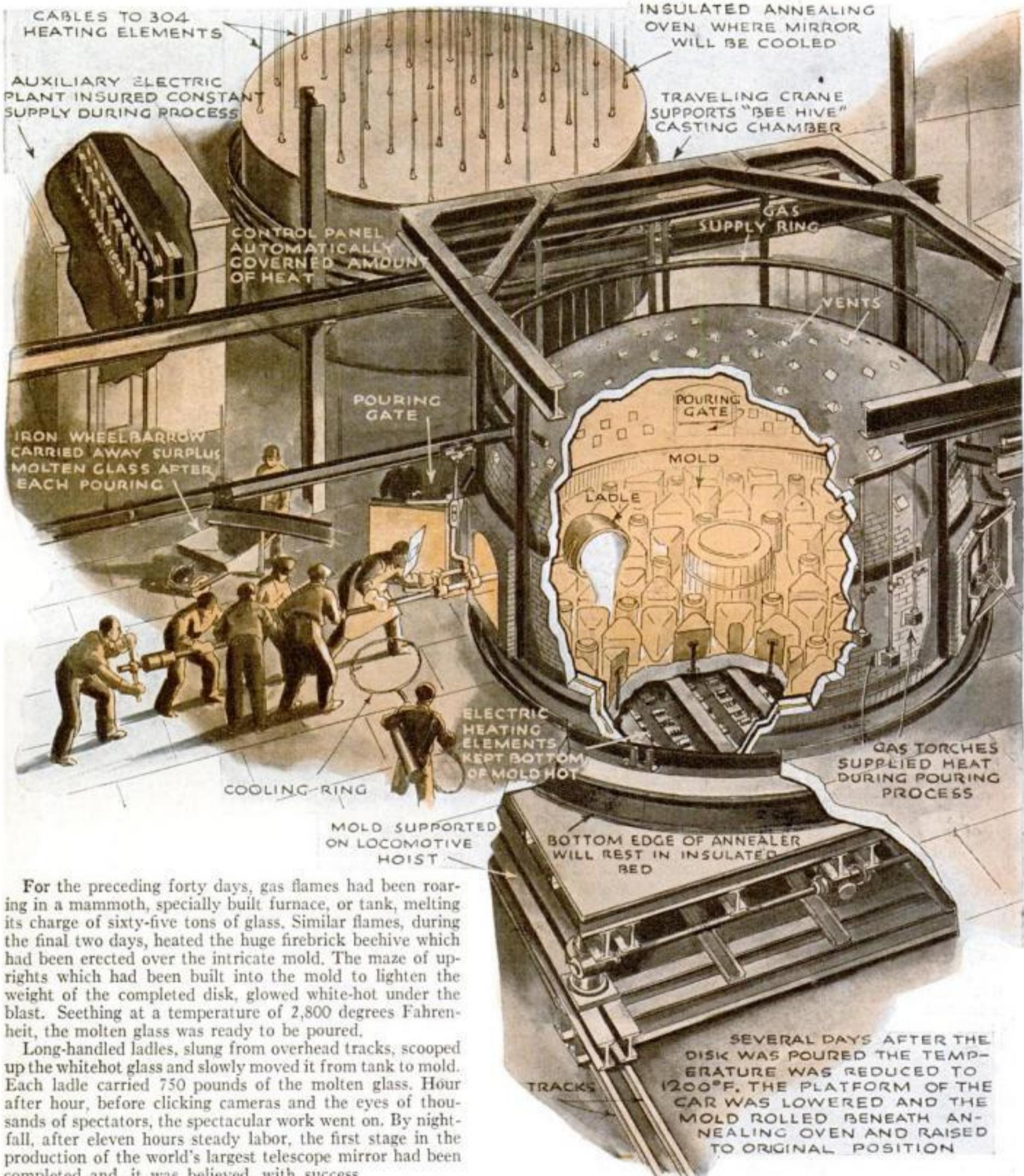
# How Twenty Tons of Molten Glass Were Poured into Hot

fused together and the whole braced with ribs of polished metal. Composite disks were next tried by putting a glass coating on a metallic base, both the metal and the glass expanding and contracting the same with changes of temperature.

Finally the decision was made in favor of a single huge casting of a special low-expansion glass which was developed at the Corning Glass Works, Corning, N. Y. Here, experts worked out a new method of constructing the mold and an improved means of slow cooling for the process of annealing, or hardening, the glass. After two years of experimenting, and when every detail of the project had been worked out, the day for the crucial pouring of the enormous mass of molten glass arrived.

By no means, however, was the great disk finished. For ten months, it must remain in an electric annealing oven, its temperature being allowed to drop a degree or two a day. During the pouring, the intense heat of the glass melted the iron bolts that held several of the core pieces and these parts of the mold floated to the surface, from which they were immediately removed. Not considered serious by the experts, this mishap may be remedied after the disk has cooled by drilling out glass at the points where the core pieces should have been.

If at the end of ten months, the disk comes from the mold whole, and free from cracks and strains, it must be shipped to the optical shops of the California Institute of Technology, at



For the preceding forty days, gas flames had been roaring in a mammoth, specially built furnace, or tank, melting its charge of sixty-five tons of glass. Similar flames, during the final two days, heated the huge firebrick beehive which had been erected over the intricate mold. The maze of uprights which had been built into the mold to lighten the weight of the completed disk, glowed white-hot under the blast. Seething at a temperature of 2,800 degrees Fahrenheit, the molten glass was ready to be poured.

Long-handled ladles, slung from overhead tracks, scooped up the whitehot glass and slowly moved it from tank to mold. Each ladle carried 750 pounds of the molten glass. Hour after hour, before clicking cameras and the eyes of thousands of spectators, the spectacular work went on. By nightfall, after eleven hours steady labor, the first stage in the production of the world's largest telescope mirror had been completed and, it was believed, with success.

# Mold in Making World's Biggest Telescope Mirror



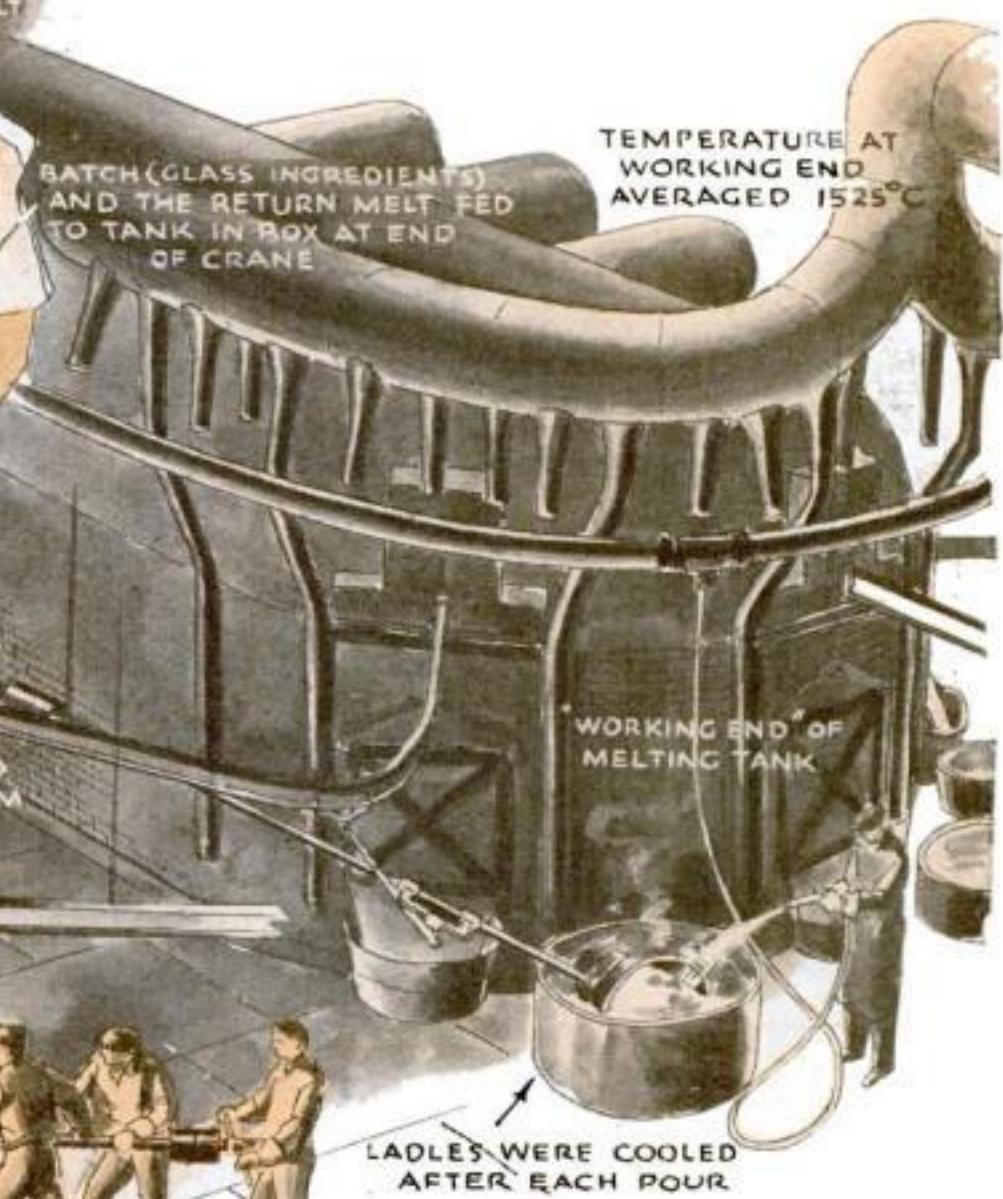
*Drawing by  
B. G. SEIELSTAD*

## TURNING GLASS INTO VAST DISK

The drawings on these two pages show the various steps in melting the glass, moving it from tank in ladles, and pouring it into the big mold which had been heated to receive it. Many months must pass before the disk will be cooled sufficiently to permit its removal from mold for polishing

Pasadena, where it will be ground and polished to an accuracy of within one tenth of the wave length of an average light beam. Because the heat generated by even fifteen minutes of polishing may distort the surface of this optical giant, the polishing must be done in short periods, alternating with long intervals for cooling. On this account, completion of the task may require several years of painstaking effort.

More impressive, even, than the giant mirror, will be the towering steel tube and mounting which will permit its shining aluminized surface to be directed toward any portion of the sky from the polestar to a point below the celes-



tial equator. No other feat of mechanical engineering has required more careful planning.

Resembling the barrel of a gargantuan howitzer, the skeleton tube, sixty feet long and twenty-five feet in diameter, will be rigid enough to carry an observer in a cartridge-shaped house to its upper end where he will adjust photographic plates and make visual observations at the main focus of the mirror. Although this house is directly in the path of the star rays, it will cut off only a small fraction of the total light that reaches the mirror.

For making spectrographs to analyze the light from distant stars, a concave mirror, forty inches in diameter, will swing into position beneath the observer's house to catch the rays reflected from the big mirror at the bottom of the tube. A hole has also been molded in the center of the mirror so some of the rays, passing through, can be photographed behind it. By this simple expedient, the reflecting telescope, called a Newtonian reflector after its inventor, Sir Isaac Newton, is changed to give greater focal length, which in optics controls the size and brightness of the image recorded.

Other arrangements of mirrors and correcting lenses will increase or decrease the normal focal (*Continued on page 118*)

# Freak Effects of Sound

By  
EDWIN  
TEALE

REVEALED BY  
NEW TESTS



Coast artillery gun fired repeatedly as part of scientists' effort to determine the exact speed of sound waves

**S**EVENTY-ONE times a huge coast artillery gun boomed at a government proving ground. Each time a zigzag line on a moving film timed the sound waves as they rushed down a four-mile course studded with microphones. Each mechanical ear was connected with a central timing device that split a second into a thousand parts.

In this way, Dr. Dayton C. Miller, of the Case School of Applied Science, Cleveland, O., gathered the data used to determine a new and exact figure for the speed of sound. Involved calculations, taking into consideration the temperature, humidity, barometric pressure, direction and velocity of the wind, show that the precise speed of sound through air is 1087.13 feet a second. Previously accepted figures ranged from 1085 to 1089 feet a second.

The new yardstick provided by the Cleveland scientist is expected to prove of importance in many fields. For in an amazing diversity of ways, sound is being put to work by science.

Ships now feel their way through dense fogs by means of an apparatus which records faint echoes sent back by unseen objects in the mist ahead. High-flying planes and distant guns can be located

through delicate sound-analyzers developed for military use. Sonic depth finders enable survey ships to chart mountains and valleys which lie beneath thousands of feet of water. Recent California experiments indicate that bouncing sound waves may soon show blind-flying pilots their height above the ground. In the world of practical application, new jobs for harnessed sound waves form a feature of the news.

In the laboratory, sound waves have been made to boil eggs, burn fingers, sterilize milk, alter chemical substances, and achieve other bewildering feats of scientific legerdemain.

A few weeks ago, Dr. G. W. Pierce, Rumford professor of physics at Harvard University, demonstrated an apparatus which makes "silent sounds" as audible as thunder. Amplified by his supersensitive device, the flickering of a match gives off a sound like the rumble of a heavy wagon; the tearing of a bit of paper is made as loud as the rattle of a machine gun; the breathing of a group of silent men thunders like a herd of stampeding elephants. Even the squeaking of cloth in a new suit is amplified until it can be heard across the room.

Such a detector would be capable of

picking up signals coming ten miles through water, in which medium sound travels about four times faster than it does in air. In wartime, the apparatus would prove valuable for sending messages because it detects supersonic waves, those of such high frequency they are inaudible to human ears.

Astonishing sound phenomena were demonstrated recently before a meeting of the American Institute of Electrical Engineers by experts of the Bell Telephone Laboratories. A new arrangement of microphones and loudspeakers, each with a circuit of its own, produced what is described as "three-dimensional" music and enabled the scientists to project re-



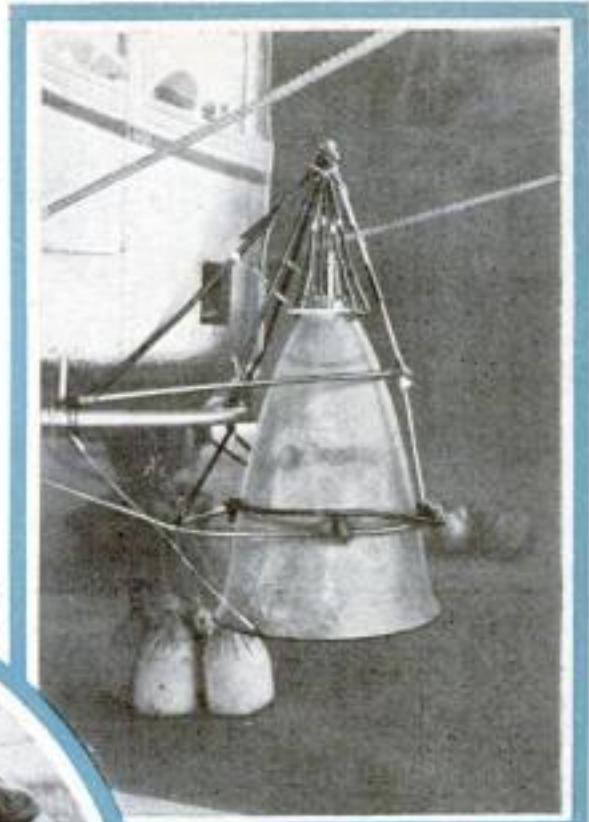
corded sounds in the manner of a ventriloquist.

Members of the audience craned their necks as the noise of an airplane circled overhead. They watched in amazement a bugler walk off the stage while the notes of his bugle continued to sound from the spot where he had been standing. They saw a tap dancer go off in one direction and the sound of his tapping feet go off in the other. And finally, they heard a revolver fired, a bullet whistle across the stage and strike a target, and then, just as a movie is run backward, they heard the shot reverse itself and travel in the opposite direction ending where it started!

Some years ago, when a troupe of singing mice, squeaking in unison, was exhibited in England, part of the audience was enthusiastic while others declared the show a fake. It developed that the latter group was unable to hear the high-pitched sounds. Our ears vary widely in the range of notes they catch. The lowest sound we hear has about forty vibrations a second; the highest about 40,000. The pitch of the sound depends upon the number of vibrations; the loudness on the length of the waves. The reason we hear the hum of a bumblebee when it vibrates its wings but hear nothing when a man waves his arms is because the man cannot wave his arms fast enough to send out a sufficient number of vibrations a second to make an audible sound.

Sir Francis Galton, the famous British biologist, discovered that cats rank first among animals in hearing faint squeaking sounds. He attributed this to generations of training in hunting mice in the dark. In his experiments, he developed a cur-

**L**IQUIDS now analyzed and bacteria killed by passing high-pitched noise through them—Sharp sound used to soft-boil eggs and experts believe right tone could be made to wreck big buildings



Above, altimeter, which, by echo of sound waves, gives flyer his altitude above the ground. At left, driving rivets as part of the sound tests



Here an Indian is "charming" a king cobra. The snake responds to the music, it is now believed, because the vibrations of certain notes partly paralyze it



The airplane detector above is one of the latest developments of sound engineers. It reveals the presence of enemy planes by picking up vibrations from their propellers and exhausts. Below, it would take thirty million buglers to generate a horsepower of sound, tests show



ious cane which became known as the "Galton whistle." It was a walking stick with a rubber bulb in the handle and a tiny whistle at the tip. Day after day, he used to walk past the cages in the London zoo, pushing the cane close to the animals and pressing the handle, noting which ones pricked up their ears at the high-pitched note. On the streets, he would sound the whistling cane behind dogs. Small ones, he found, would turn around but big dogs apparently failed to hear the squeak.

Flashing neon lights in a laboratory in California are seeking other facts about sound in connection with the songs of

wild birds. The lights are "photographing" the trills and warbles of birds for scientific analysis. The apparatus used in the work was designed by Dr. Milton Metfessel, chairman of the department of psychology at the University of California. Variations in the intensity of the neon light are produced by the singing of the caged birds and these variations are recorded on a whirling disk by a stream of dots which are described as giving a picture of the song. Already the studies have revealed how far birds can exceed the human voice in range of tones.

From Johns Hopkins University, in Maryland, comes word of a remarkable discovery in connection with high-pitched sounds. Dr. J. C. Hubbard has found he can analyze unknown liquids in the chemical laboratory by passing high-frequency waves through them. The fact that no two substances transmit the waves at exactly the same speed explains the achievement. Analyzing the speed of the waves through the solution, he can determine what the liquid is, what (*Continued on page 120*)

# INVISIBLE LIGHT BEAM NOW USED TO GUIDE THE BLIND

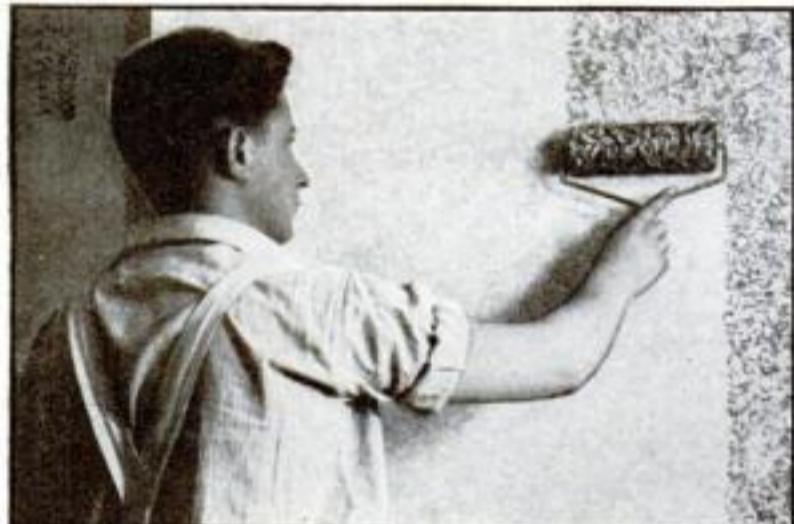
LIKE threads that can be followed through the darkness, beams of light aid the blind to "feel" their way along the halls and corridors of a building, in a new system demonstrated in New York City. To use it, a detector, comprising a light-sensitive cell, an electric relay, and a buzzer, is carried in the hand. While the user walks in the path of the beam, the buzzer sounds faintly. If it stops, the user pauses to correct his direction. Projection lanterns mounted at suitable points provide the beams, which, in one form of the system, include a main beam traversing the length of a corridor and auxiliary beams indicating side doorways. The light-beam system is intended especially for use in institutions for the blind and in office buildings and factories employing blind workers in need of such guidance.

Below, close-up of detector that sounds buzzer to guide the blind



This buzzer, which is carried in the hand, enables the blind girl to follow a beam of light, as the buzzer stops when girl moves out of the beam

## ROLLER MAKES SMOOTH WALLS MOTTLED



WALLS of solid color are given a mottled pattern in any desired combination of tints, by a new tool intended both for amateur and professional decorators. This implement, a roller with a crinkly leather surface, is simply charged with wet paint and drawn along the wall imprinting the design as it rolls. Patterns of striking beauty, according to the maker, may be obtained by the application of contrasting colors, as shown in illustration at left.

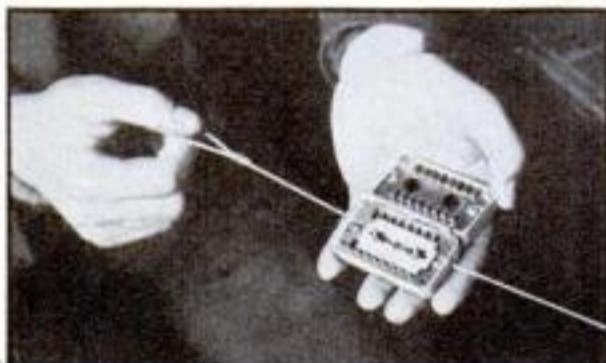
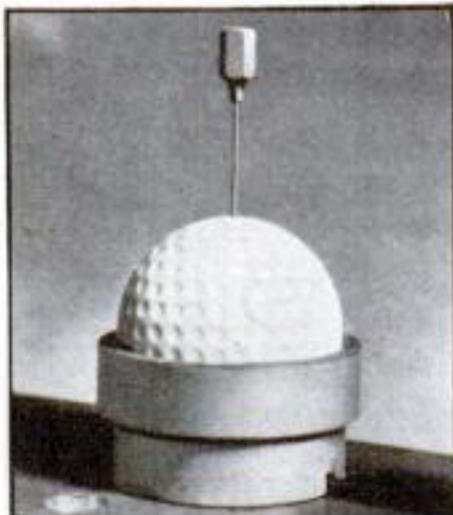
## "NEEDLE" GOLF BALL TO LENGTHEN DRIVE

A NEW golf ball that is given a "shot in the arm" is expected to travel farther and last longer. Long flight is obtained in the ordinary ball by winding rubber at high tension about a rubber core, which some-

times contains liquid. In making a cover that will not cut easily, so much heat is applied that some of the resiliency of the rubber winding is lost. Now one manufacturer restores the internal pressure of the tough-cover ball by forcing additional liquid into the core with a needle resembling a hypodermic syringe. The ball is said to lengthen the golfer's drive by twenty to thirty yards, while at the same time its cover is declared to be virtually proof against cutting by inexpert handling of the clubs.



Above, automatic machine that injects liquid into golf ball to raise internal pressure. Right, needle used in doctoring ball



## HOOK HOLDS STRING THAT OPERATES RAZOR STROP

OPERATED by a string that is attached to any convenient hook or nail, a compact stropping device for razor blades has been introduced in Germany. When the string is held taut with one hand and the strop is drawn back and forth along it with the other, rotating cylinders in the device give the blade a keen edge. The picture above shows the razor strop opened to reveal the blade-sharpening mechanism.

## HEAVY ARMOR SHIELDS COP FROM THUGS

POLICE of Columbus, Ohio, have equipped themselves with a modernized adaptation of medieval armor in order to cope with dangerous outlaws of the present day. Jointed plates of heavy steel cover the wearer's body to shield him from gunfire, while a window of bullet-proof glass, a convenience not possessed by warriors of the Middle Ages, gives the officer a clear view of his adversary. Through a gun port at the right of the costume, the cop can shoot it out with a thug.





Left, radio amateurs sending out messages for aid from center of flooded district pictured in circle



## RADIO HAMS SAVE FLOODED DISTRICT

WHEN the little towns of Wallace, Washington, and Kellogg, Idaho, were isolated by floods in the Coeur d'Alene area, amateur short-wave radio operators established communication with the outside world and brought sorely needed relief. Stations W7BDK at Wallace and W7AQK at Kel-

logg transmitted continuous appeals for assistance to a Spokane amateur, Henry Sturtevant, operating station W7AMA. Relief went forward immediately, by plane and by boat, bringing food, clothing, fuel, temporary shelter, and medical supplies. Later, station W7BEV in Spokane and

W7CBU and the emergency station W7BUZ in the stricken area took up their share of the work. Thereafter for 120 hours, the radio amateurs, without compensation or sleep, maintained constant contact between the flood region and Spokane. Afterward, they sent reports to news agencies.

## TALKING ROBOT SALUTES VISITORS



Phonograph record that gives robot its voice and mechanism that causes action



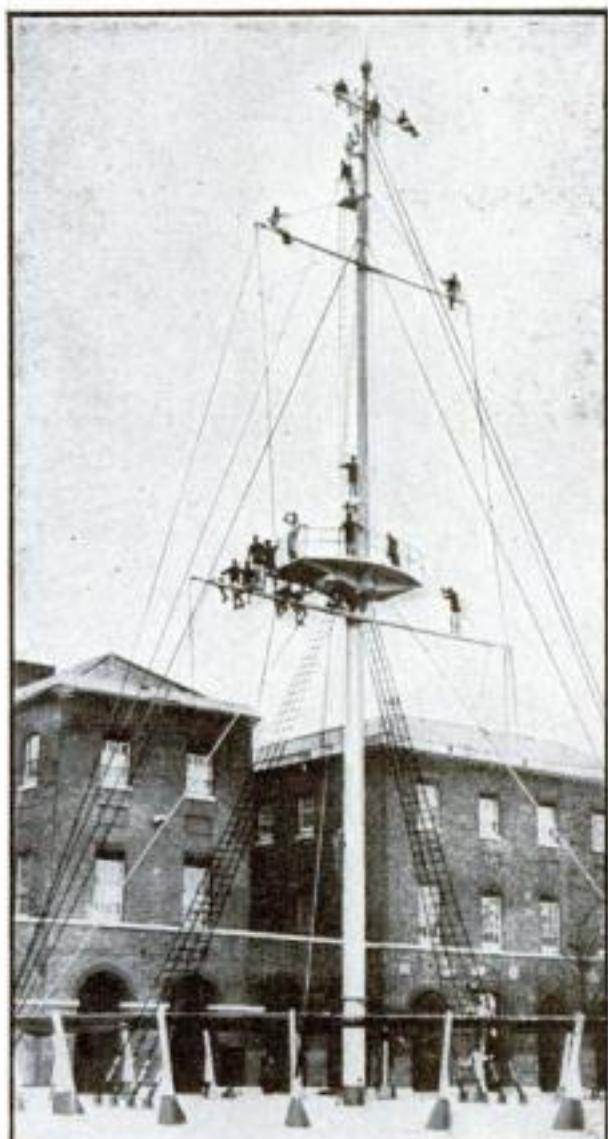
Mechanical man salutes and speaks to visitors at Franklin Institute



Bathroom scales that weigh up to 250 pounds

## TINY BATHROOM SCALES WEIGH 250-POUNDER

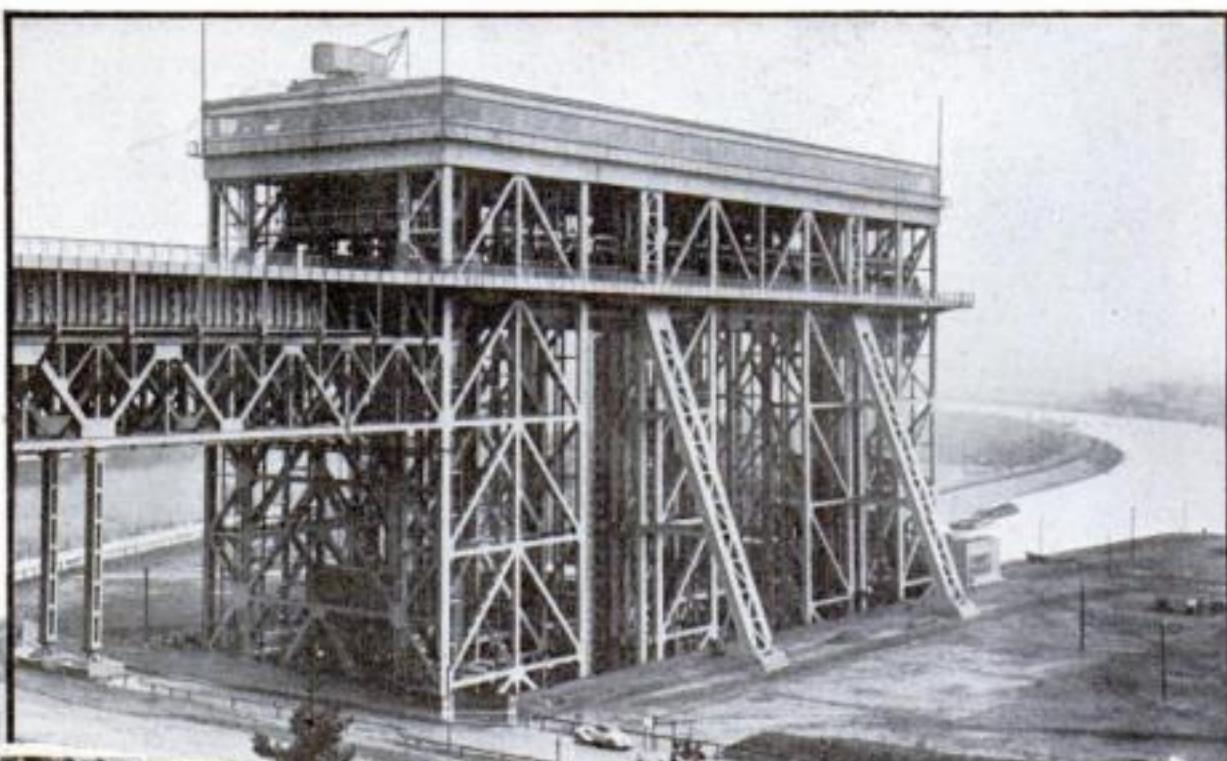
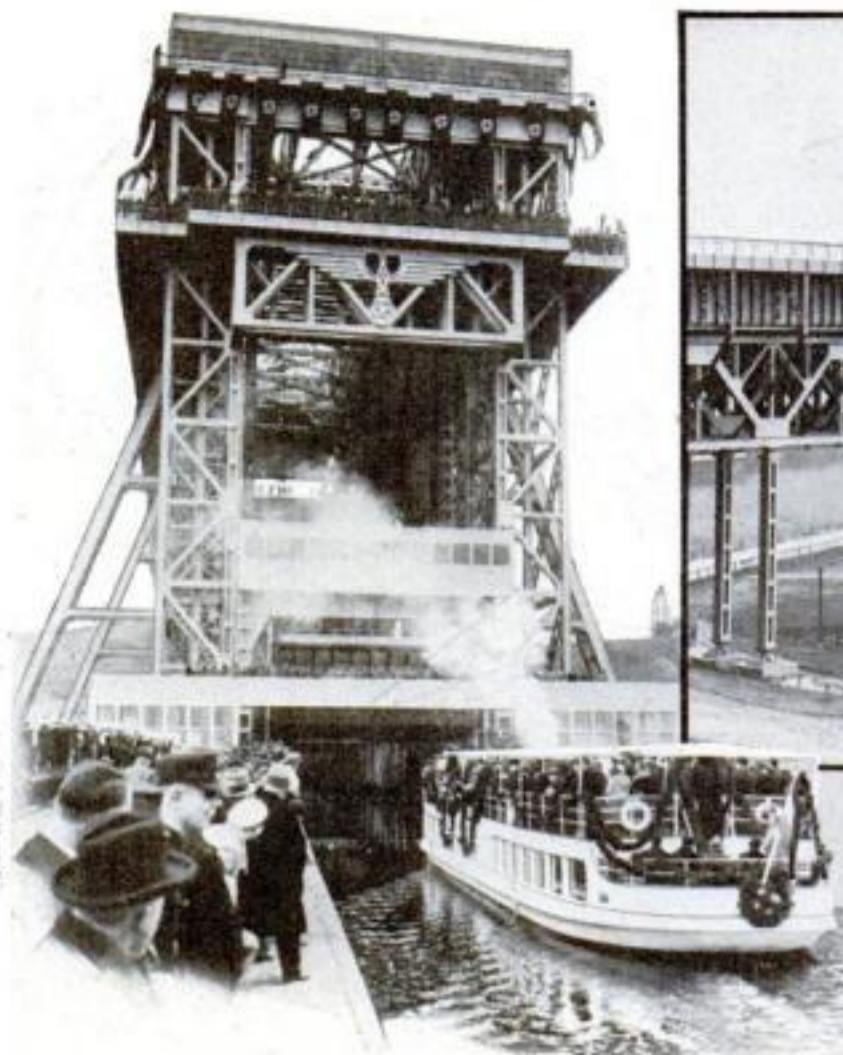
COMPACT bathroom scales, hardly larger or heavier than a good-sized book, are being marketed by a Detroit company. Nine inches long and eight inches wide, the scales record weights up to 250 pounds. A lever at one end permits adjustments to give accurate weight. The scales are finished in four different colors.



## TRAIN SAILORS ASHORE ON OLD SHIP'S MAST

DRY-LAND training for England's future sailors is furthered by a 150-foot mast from the old German battleship *Baden*. The mast was erected recently at the boys' naval training school at Gosport, England. The mast is used for the purpose of giving the cadets confidence when working aloft. A safety net to catch the unlucky ones is stretched around its base.

# WORLD'S BIGGEST ELEVATOR NOW RAISES SHIPS IN CANAL



Left, first barge passing through world's biggest ship elevator. It can raise a ship 118 feet in five minutes. Above, general view of the elevator

COMPLETED on schedule after eight years of labor, the largest ship elevator in the world is now speeding marine traffic at Niederfinow, Germany. The structure replaces a series of four locks in a barge canal from Berlin to the seacoast, and raises a canal barge 118 feet in only five minutes. This is done by hoisting the vessel bodily within a bathtublike tank (P. S. M., Sept., '30, p. 43).



This radio set, which fits car seat, as shown, can be hooked to house current and used indoors

## RADIO SET CAN BE USED IN YOUR AUTO OR HOME

WHEN not in use during a drive, a dual-purpose radio receiver, developed by General Electric engineers, may be removed from the car and used in the home, since it operates equally well from an automobile battery or the standard 110-volt household current. The receiver is designed to fit comfortably into the front, back, or rumble seat of a car, its height making it a convenient arm rest. A five-tube superheterodyne circuit is employed in the set.

## CASH FOR DEAD ANTS

Bounties have been paid by governments for the killing of hawks, crows, rattlesnakes, and wolves. Now comes word of a bounty on ants. The mayor of Barra Mansa, Brazil, has offered a cent for every 100 red ants killed in his town.



## TINY PAPER PUNCH CUTS QUARTER-INCH HOLE

OCCUPYING little space in an office drawer, a midget paper punch, recently placed on the market, is always handy when needed. When a letter sheet or index card is slipped into its metal guide, as illustrated above, a thumb-operated plunger makes a neat quarter-inch hole, rendering the use of more bulky paraphernalia unnecessary.

## NEW METER HELPS DRIVER PARK CAR IN CRAMPED SPACE

EVEN an inexperienced driver can back a car into a cramped space at the curb, with the aid of a dashboard parking meter that shows him how and when to turn his steering wheel. Just as the driver himself is abreast of the rear bumper of the car behind which he wishes to park, he pulls a button on the instrument that moves the pointer. He advances until the pointer reaches a red arrow on the dial rim, stops, turns the steering wheel all the way to the right, and backs until the pointer reaches a white arrow. The wheel is then turned to the left as far as it will go, and the car will glide into the space. The pointer is operated by an electric pawl-and-ratchet movement, connected to a rotating contact on the speedometer shaft. Letters on the dial help in setting the indicator for various lengths of wheelbase.

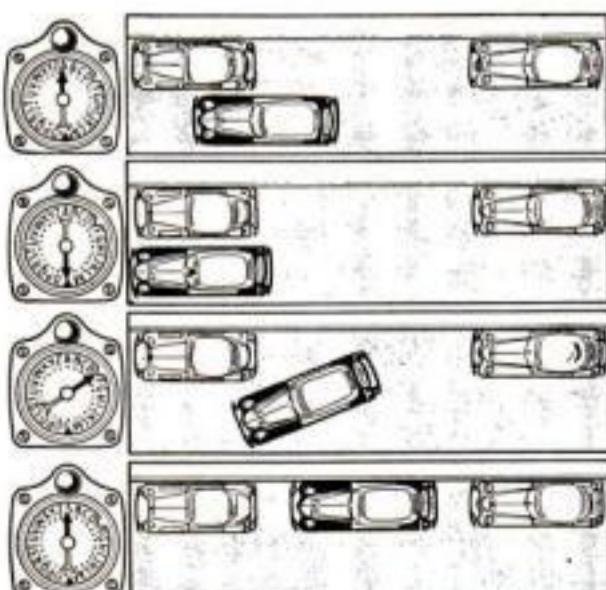
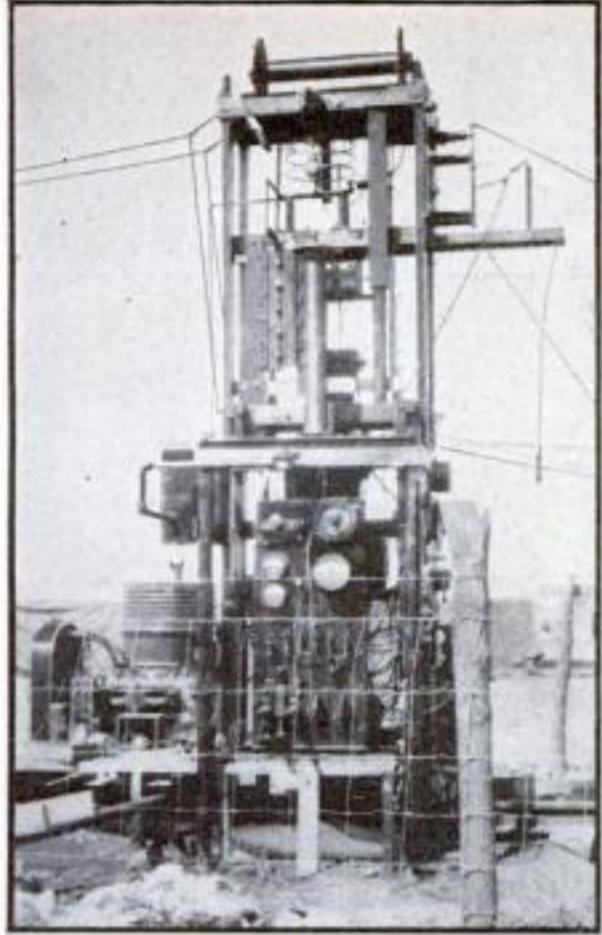


Diagram shows how meter guides driver when he is endeavoring to park his car in limited space



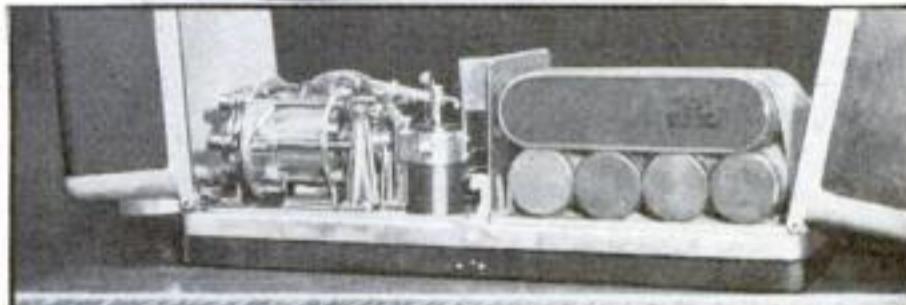
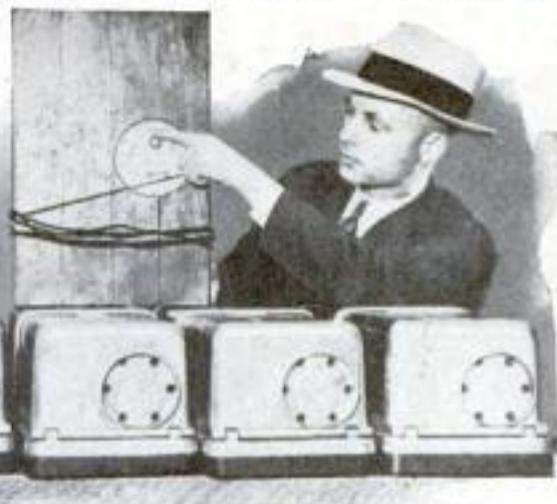
This meter is attached to car's dashboard and aids driver in backing his machine against the curb

## ELECTRIC MACHINE GUNS WORRY POLICE



Transmitter built for radio-power test

SUMMONED by a second-hand dealer to investigate the strange contents of a packing box he had bought "sight unseen," police officials of Los Angeles, Calif., wondered if they were confronted with a terrible new gangland weapon. The box contained five machine guns of careful workmanship and unheard-of design, apparently intended to be operated by electricity. Police apprehension vanished when an investigation showed the deadly looking contrivances were the product of a San Francisco inventor who had been seeking to devise a "burglar-protection gun," and who had thrown away his models.



At top, five electric machine guns found by Los Angeles police. Above, close-up of one of the guns showing batteries and mechanism

### PLAN TO RUN RAILROAD TRAIN BY RADIO POWER

IS IT feasible, at present, for a railroad train to draw its power from radio waves, dispensing with a self-contained power plant or a third rail? As this issue went to press, preparations were reported going forward to propel a rail car forty-two miles along the tracks from Boise City, Okla., to Clayton, N. M., by radio power. The picture above shows the transmitting station erected by a California inventor at Boise City for the proposed trial. Hitherto experiments with radio power have been confined to a few yards' distance, and to a modest amount of energy, sufficient merely to light lamps or perform other small tasks.



Big rubber balls help plane to land safely

### PLANE LANDS IN SAFETY ON HUGE RUBBER BALLS

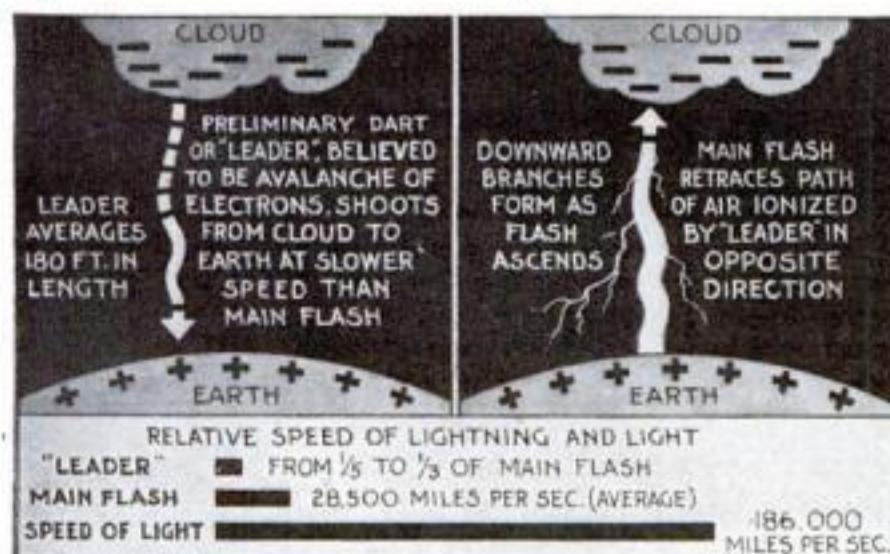
HUGE rubber balls, inflated with air, act as shock absorbers in the landing gear of a safety plane designed by a German inventor. Mounted on axles like wheels, they cushion the impact when the plane comes to earth and prevent damage in case of an inexpert landing. The designer maintains that the balls will also act as pontoons and aid in keeping the machine afloat in the event of a forced landing upon water. In the original design of the balls, their size is so great that the inventor found it impossible to make them retractable. As a result, they are enclosed in streamlined housings which reduce wind resistance.

### LIGHTNING BOLT FLIES UP FROM EARTH, NEW STUDIES SHOW

How a thunderbolt forms and how fast it travels have been learned for the first time, with the aid of a high speed camera of unusual design, by two research engineers working in South Africa. Photographs they obtained during electrical storms show that the main flash of a stroke of lightning is nearly always preceded by a faint "leader," which appears as an elongated, luminous dart traveling from a cloud to the earth. This leader averages 180 feet

in length, is unbranched, and speeds downward at a pace ranging from 810 to 19,900 miles a second. The observers believe it to consist of an "electron avalanche" that ionizes the air, making it electrically conductive and thus paving the way for the main flash. As soon as the leader strikes the earth, the engineers found, the main flash starts upward along the same path, traveling at a much higher speed and averaging 28,500 miles a second, or less than one-sixth of the speed of light.

The main flash resembles a soaring flame more than a moving dart, and often casts out branches as it ascends. These branches point toward the earth, so that ordinary photographs of lightning give the erroneous impression that the main bolt is directed downward, instead of upward. A camera with two lenses revolving in a circle timed the flashes.

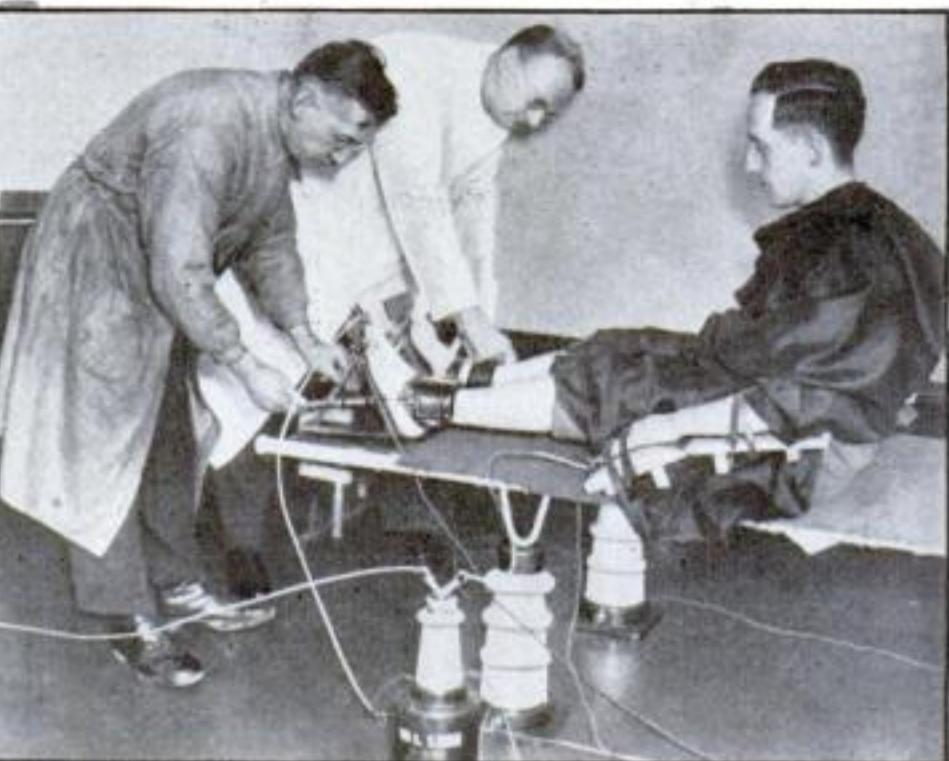


Typical lightning flash, showing branches that point downward as the main bolt flies upward

This woman subject is receiving a shock of 180 volts through her hands as part of the new electrical tests



BY SUBJECTING themselves to nerve-racking electrical shocks, volunteers in a Berlin, Germany, laboratory are aiding an investigation that may reduce the number of electrical accidents in industry that cause death. Hitherto little has been known about the effect of powerful currents upon the body, but with the present tests experimenters hope to make clear its behavior as a conductor. The resulting data will aid in adapting electrical fittings of proper design and voltage to any industrial use where accidental shock may occur. In some cases, for example, it may be found that industries, operating rooms where a high-temperature causes the workers to perspire freely, employ electrical apparatus of too high a voltage for safety. In such cases the test data will show the amount by which the voltage should be reduced to eliminate the hazard. A subject volunteer-



Above, volunteer subject is being strapped into an "electric chair" to test the effect of severe electrical shocks on the body

Left, thumb burned in an electrical accident. The high voltages are specially dangerous as they destroy skin resistance

ing for the tests is strapped in an apparatus resembling an electric chair, and electrodes are applied to his bare hands and feet. A system of pressure plates regulates the electrodes to give the same firmness of contact as if the subject were standing upright on a grounded metal floor. When the observer closes a switch, an electric current of predetermined voltage is shot

through the subject, and dials and meters record the resistance of his body and other vital data. By manipulating controls, the observer can send the current between the subject's hands, a hand and a foot, or both feet to simulate various ways in which a shock might be received accidentally. Some of these forms of shock are more dangerous than others, and those involving the most hazard result from electric currents passing close to the human heart. As little as one-tenth of an ampere, or the current required to light a ten-watt bulb, may cause death if it passes directly through the heart muscles. High voltages are dangerous not only because they directly increase the current flow but also because they break down the resistance of the human skin, which normally aids in protecting the internal organs.

#### VEST-POCKET CAMERA TAKES TINY PHOTOS

TAKING pictures the size of a postage stamp, a pigmy camera has just made its appearance in England. It uses tiny rolls of film good for eight exposures. So small that it easily slips into a vest pocket, the new camera follows the general design of other small cameras.



Vest-pocket camera takes stamp-size photos

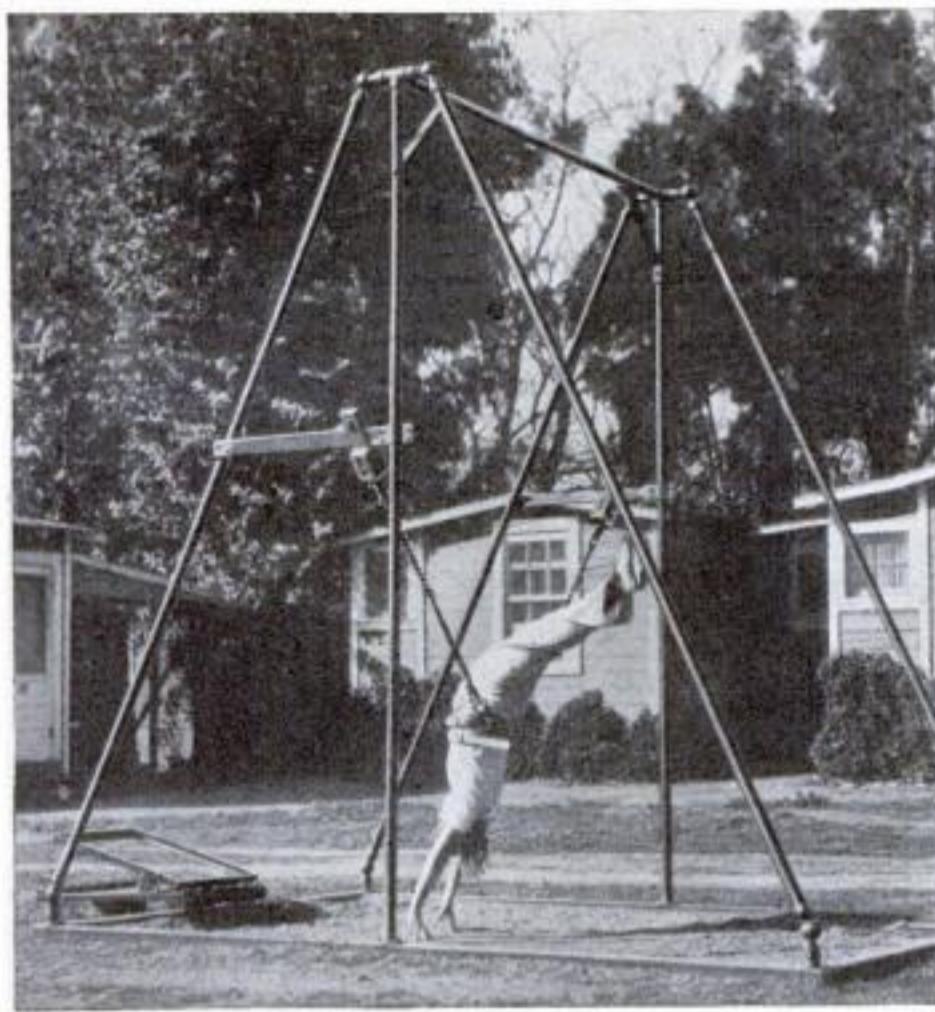


#### POLICE CARRY BROADCAST OUTFIT

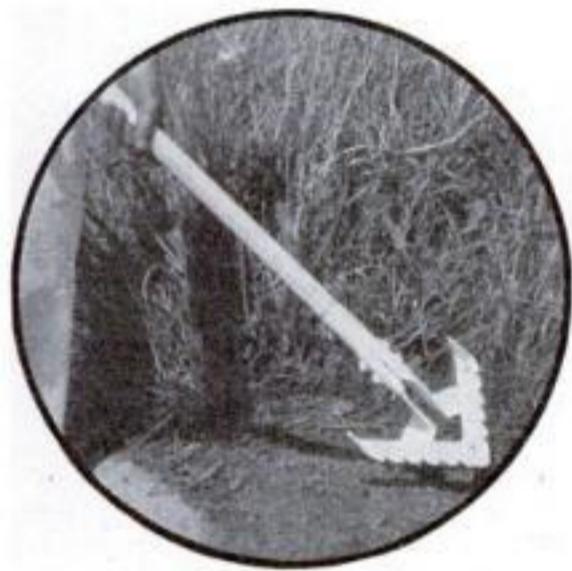
SPECIAL police in Vienna, Austria, have been turned into walking broadcasting stations by the development of a midget radio sending set which is hung around the neck by a wire that also serves as the aerial. The sixty-volt battery, which sends the signals for a distance of two miles or more, is slipped in an outside coat pocket. A small, bell-shaped sending key is held in one hand while the thumb taps out the Morse code signals which are used. The sets operate on the regular police wave length. Equipped with this outfit, the patrolmen are able to carry on a two-way conversation with headquarters or with radio cars and thus expedite apprehension of criminals.



# GYMNASICS LEARNED WITHOUT DANGER



Frame, harness, and cables help student learn gymnastics in safety



Ten garden tools are combined in this one

## TEN GARDEN TOOLS IN ONE

COMBINING a whole tool shed full of gardening implements into a single labor-saving device is the feat accomplished by a Fort Worth, Texas, inventor. His curious tool, resembling a spear with a large jagged head is said to do the work of a hoe, a spade, a drill, a cultivator, a pulverizer, a rake, a weeder, a grub-hoe, a hedge ax and a lawn edge trimmer. According to the inventor, the combined gardening implement accomplishes work twice as fast as the tools it is designed to supplant. The tool is specially designed for farmers and home owners who do their own garden work.

## ELECTRIC WAND TESTS BOY'S BIRD KNOWLEDGE

ELECTRIC wands test the ability of boys to recognize any one of forty-eight American birds at the Children's Museum, in New York City. The electrified testing device was worked out by Boy Scouts. On a flat wooden background, the colored pictures of the birds are pasted with a metal button beneath each. Below are the names of the birds, placed in different positions. They also have electrically connected buttons under them. The teacher touches the button beneath a name with a metal-tipped wand attached to a wire. The child being tested, using another wand, touches the button beneath the bird he thinks corresponds to the name. If he is wrong, nothing happens. If he is right, contact is made and a buzzer sounds. The device has proved popular.



AMATEUR gymnasts may learn the fine points of tumbling and turning somersaults and flipflops, without risk of injury, with the aid of a training device recently placed on the market. Devised by a professional athletic instructor of Oakland, Calif., it consists of a sturdy frame and adjustable cables ending in rollers that run along a horizontal track. A harness, worn by performers, is supported by the frame. Weights, moving up and down in the hollow central pipes of the frame, take up the slack when the gymnast does a somersault in the air.



## THERMOMETER ON STAFF GAGES HEAT IN GRAIN

SHAPED like a javelin, a thermometer has been developed by experts of the U. S. Department of Agriculture for keeping track of the internal temperatures of bins of grain. The pointed head, containing a thermometer, is attached to a slender handle made up of sections of metal pipe. Thus the handle can be lengthened or shortened according to the depth of the bin. By thrusting the javelin deep into the stored grain and then taking the reading when it is withdrawn, the operators of elevators and mills can note rising temperatures and take steps to prevent fires due to spontaneous combustion.



Roller tube cap that spreads shaving cream

## SHAVING CREAM SPREAD WITH ROLLER TUBE CAP

A TUBE cap with a roller, designed to leave an even layer of brushless shaving cream behind when run across the face, has been put upon the market by a mid-western manufacturer. It is said to do away with the necessity of rubbing in the cream by hand. All the shaver has to do is press the tube as he rolls the cap over his beard. The new device is being manufactured to fit all the popular-sized tubes of brushless cream. According to the manufacturer, the new cap is more sanitary than the old method and can be used to give the face a satisfactory and quick massage following the shave.

# Human Faces



A lost nose is restored with a flap cut from the forehead. The entire operation is first completed on a mask, above, made of glue

## *Disfiguring Wounds Repaired with Living Tissue so Lost Beauty is Perfectly Restored*

By

ANDREW R. BOONE

**I**N NEW YORK a man smiles because a section of a nerve has been transplanted from his thigh into his face. Another can present a whole face to the world only because a six-inch section of a rib has been used to rebuild his jaw bone. Elsewhere men and women boast new thumbs, new skin where once terrible burns made them unsightly, new eyebrows, ears, and noses. Twenty operations gave a young girl, terribly burned, a new face.

Every week the skill of plastic surgeons restores to health and happiness persons, young and old, who through accident or disease have lost important bodily functions or suffered marred features.

As I searched medical literature and talked with famous surgeons engaged in the plastic repair of human beings, artists working in living tissues, I found that many almost unbelievable surgical feats are being performed. Photographs of persons taken before and after they have been restored to normal appearance, and in many cases made more beautiful than they originally were, attest the marvels of what is at once the oldest and newest form of surgery.

Today a skilled plastic surgeon can take a square of skin from any part of the body and transplant it to any other part

of the body, and it will grow. Whether it be thin as a calling card or a quarter inch thick, given proper protection and treatment, such a transplantation will cover an old defect and soon thrive as well as though it had been growing in that particular spot since infancy.

Skilled surgeons, famous among their colleagues but little known to the country at large, perform miracle after miracle. Cases regarded a few years ago as hopeless now are restored in a few weeks or months.

Surgeons consider as one of the most daring operations in plastic surgery that in which a face is reconstructed following radical removal of cancer. Yet Dr. Vilray P. Blair of St. Louis recently took away half of a man's face during such an operation, and a few months later restored his face in full by transplanting from his chest wall a blanket of flesh a quarter of an inch thick, seven inches wide, and fifteen inches long.

Dr. Blair removed the malignant growth, together with a plentiful border of normal tissue, because he knew exactly how much he could replace. Therein lies the secret of the plastic surgeon's success. He takes away nothing he cannot restore from some other part of the body.

Grafting of nerves to restore functions,

to bring back life to a paralyzed face, should occupy one of the most important chapters in the history of recent advances in plastic surgery. For several years, expert surgeons have dared to transplant sections of nerves, but in nearly all cases from four to six months would elapse before the patient became aware of improvement. Then a well-known surgeon of New York found that he could speed up the recovery of the ability to move the muscles of the face through a single change in operative procedure.

Examination of a patient showed a facial nerve to be seriously injured from an accident. A few days later a section of a nerve in the thigh was cut loose and, instead of planting it immediately in the face, the surgeon left it in its bed. Three weeks later he operated again, now completing the delicate transfer. When the patient awoke, it was with a section of the important leg nerve permanently embedded in his face.

He had been told that transplanted nerves do not function within four months, yet after thirty more days had elapsed, motion in his face was partly restored and a few months later it was nearly as good as new. The three weeks rest in its old bed had emptied the conduits in the transplanted section so that it permitted the



Two photographs of the former heavyweight champion, Jack Dempsey. At right, as he was when he defeated Jess Willard. Left, as he looked after his nose was remodeled

# Remodeled by Skilled Plastic Surgeons •



Surgeon and nurse, with patient on the operating table, ready to begin the delicate task of remodeling a nose with transplanted tissue



On this life mask, the nose to be cut down is actually made smaller before the patient enters operating room



Above, patient wearing metal plate to keep plaster, used in making the mask, from running down the neck. In background is finished mask. At left, plaster casts of burned hands. These are studied before operation is performed

nerves to pass through and make connections with the muscle again. While it is difficult to explain this phenomenon, the result is evident.

Plastic surgery need not be confined to a single physical change, however. Take the case of the young girl whose future was dimmed by an automobile accident that left her face burned beyond recognition. In a series of twenty operations, Dr. Howard L. Updegraff of Hollywood performed twenty-five skin grafts. He made new eyelids, nostrils, and ears with grafts from her legs; new eyebrows from her scalp; new upper lip, from a tube flap from the chest; reconstructed her mouth with an abdomen graft, and finally built her face into shape by grafts from her arms.

Hers is an extreme example of cases grown all too common since the World War. The machine age causes more faces to be burned than did the war. Yet through three types of grafts, tube flaps, stent grafts, and the larger skin grafts, severe burns are being removed and pleasant features restored.

The plan for reconstruction of the face is aided by studying old and new photographs and plaster face models built up to meet natural contours. The problem then may be divided into surgical stages and the time element scheduled. The character and number of skin grafts indicated,

as well as the possible use of tube flaps and the territory of their origin, must be planned.

Major scars often are removed by "waltzing" tube flaps from nearby areas. Here the surgeon literally builds a tube of skin, leaving both ends attached to their original locations for three weeks. Then, circulation having been reestablished, he cuts one end loose, swings it around in the direction it is to be moved, implants it in a trap door under the skin and awaits development of new circulation before swinging it forward again. In one case such a flap was "waltzed" four times from a chest before it finally began to fill old defects and relieve tensions of a scarred face.

One of the most delicate operations is the lining of a nose injured by fire. In a recent case the surgeon first molded an

impression in wax, took thin slices of skin from each arm, rolled them raw side out on the wax molds and placed them in the nasal passage. A few days later he removed the wax, and the patient had nostrils as good as new. In the same way the mouth or eyelid may be lined.

Not infrequently grafts containing more than 100 square inches of skin a quarter-inch thick are moved from one to another part of the body. The war may be thanked in part for this advance, for during the conflict it became necessary to reconstruct hundreds of thousands of men whose faces and bodies had been disfigured.

In these cases surgeons all over the world, in a new phase of surgery advanced in large measure by Dr. Ferris Smith of Grand Rapids, Mich., found that skin would grow better when used as a graft if equal pressure, amounting to thirty millimeters of mercury, were applied. This pressure, they discovered, was sufficient

to shut off the arterial and venous supply, allowing the graft to live in the lymph juices and blood serum the first week or so following the operation, during which time the little blood vessels of the graft gradually grew or reopened through the new area.

The skilled plastic surgeon completes a large part of his work days, or even weeks, before the patient goes under the knife. Particularly is this true in the remodeling of some feature of the face, such as reconstructing a nose or restoring normal features to a burned or badly scarred face.

As I observed a plastic surgeon preparing to reconstruct a nose recently I noted the great detail with which the problem was studied. First, the patient sat facing a five-view mirror, composed of three sections. Light shone full in his face through an oblong opening near the bottom of the center mirror, while spotlights in two corners of the room cast their brilliant beams down on him. In this way both surgeon and patient considered not only his present features, but possible effects of physical change.

Then the patient sat, or rather lay, for a plaster cast of his face. An ingenious collapsible plate, made of metal, fits down around the face to prevent the plaster, as it is poured, from running down his neck. From this cast was made a male cast, and by adding modeling clay the surgeon built up the nose until a profile satisfactory to the patient

Below are the instruments used by a plastic surgeon. Note the razorlike knife with which skin graft is removed and cut to fit



Before starting reconstruction work on a face, the surgeon obtains a life-sized photo of it against a white field. The subject is lighted from three sides

had been reached. Next the surgeon carved a pith wood model representing the built-up nose section. Now he was ready to operate.

In the operating room, he quickly re-

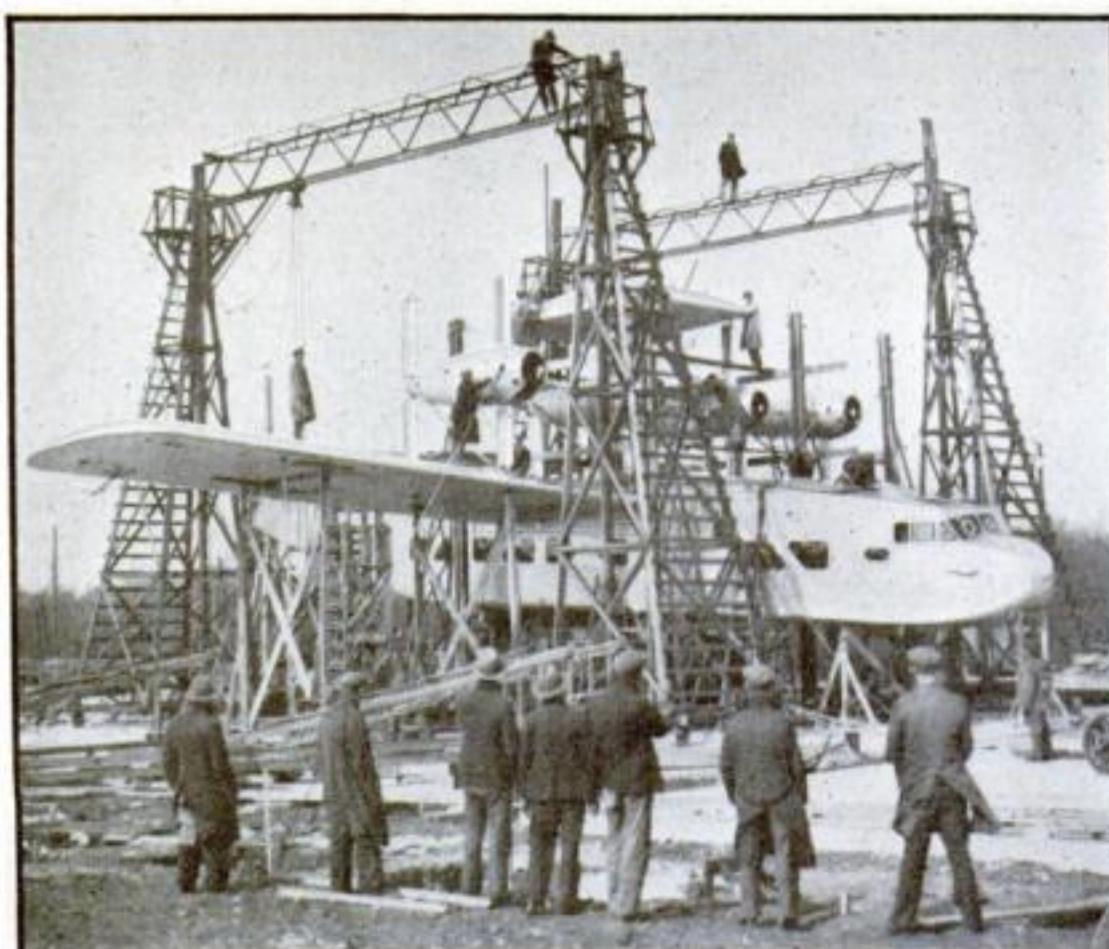
moved a piece of costal cartilage from a rib, dividing the cartilage into two parts. One of these he "refrigerated" under the skin of the abdomen for possible future use. The other he trimmed with his razor-like knife, and inserted it beneath the skin of the nose. *(Continued on page 116)*

## GIGANTIC NEW AIR LINER IS TOO BIG TO BUILD INDOORS

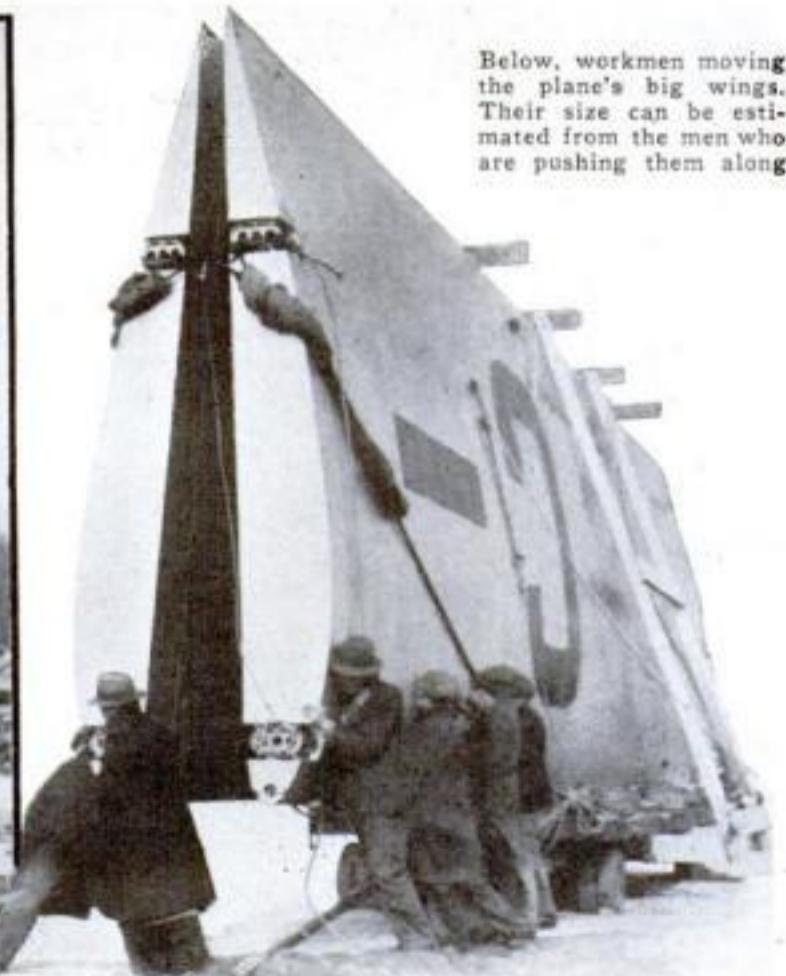
Too big to build indoors, a monster air liner is nearing completion in an open factory yard at Rochester, England. The quadruple-engined machine is destined for

passenger transport service, and when placed in operation will be the largest in regular use on British air routes. Overhead trusses were erected by the work-

men to aid in assembling the giant plane and to help support its wings during the arduous process of construction, as is shown in the photograph below.



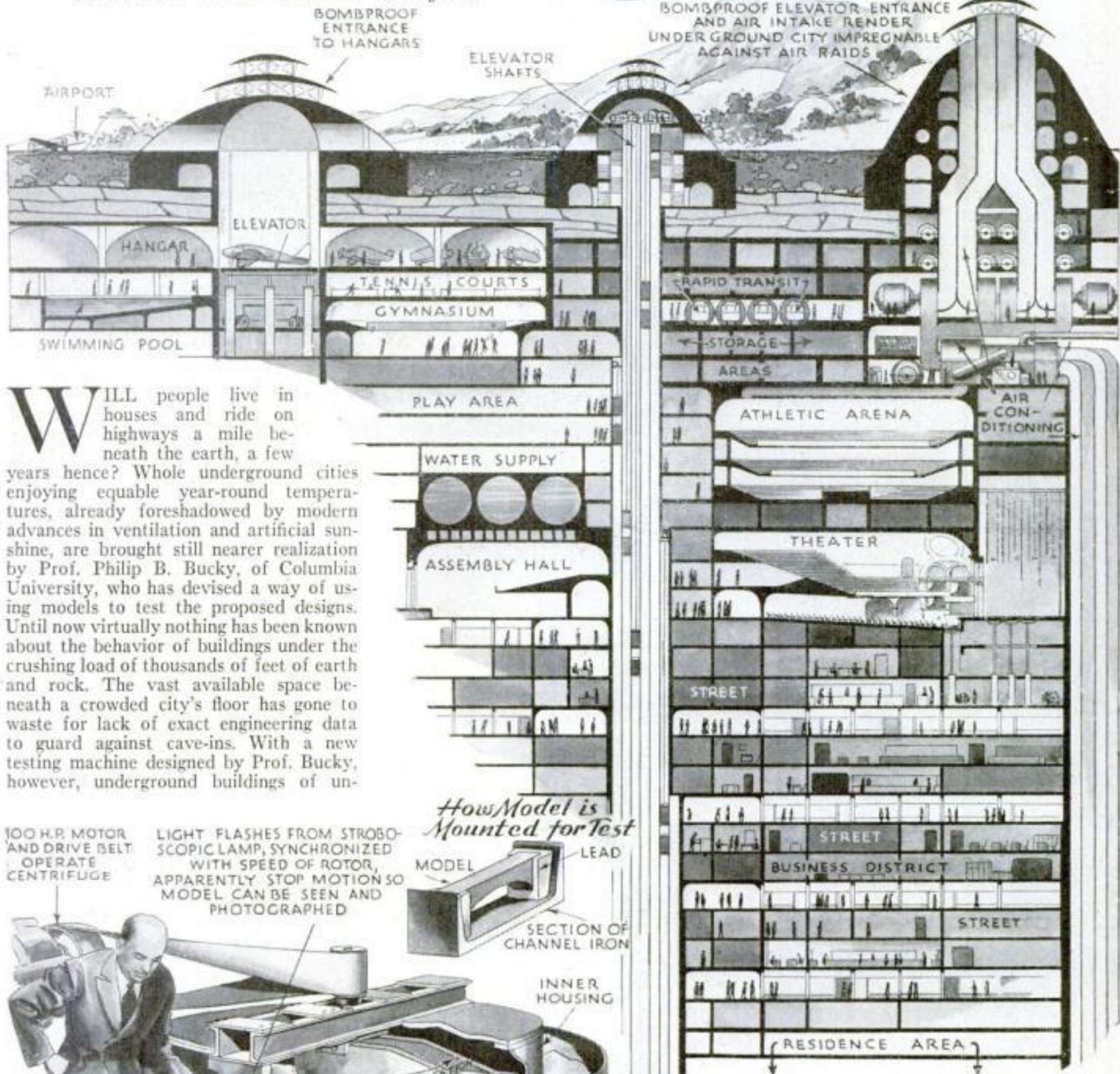
Assembling the gigantic air liner which is to be put in regular use



Below, workmen moving the plane's big wings. Their size can be estimated from the men who are pushing them along

# Cave Cities of Tomorrow

*Artificial Sunshine to Light Homes  
Erected Mile Below Surface*



Models of underground structures are whirled at terrific speed in this machine. In this way their ability to withstand the pressure of a mile of earth and rock is determined with great accuracy.

preceded size, as depicted on this page by our artist, may safely be planned in advance. The new machine employs a principle previously applied by Prof. Bucky in a smaller device for investigating the design of mine shafts and tunnels. A model of a proposed underground structure, fashioned of the same materials to be used in the full-sized building, is placed in the machine and whirled at terrific speed. Adjustments regulate the centrifugal force that tends to tear the model apart, to simulate the load the full-sized structure will carry at any depth up to 6,000 feet. An observer may watch the behavior of the model through a special eyepiece or record it with a motion picture camera as it is whirled in the machine with destructive violence.

## PLANE'S NEW FUEL CUTS FIRE HAZARD



DEVELOPED in an attempt to banish the dreaded hazard of fire following an airplane crash, a new safety fuel, made by a chemical process known as hydrogenation, was successfully tried out in flight tests at Roosevelt Field, N. Y., the other day. In liquid form, it cannot be lighted by a match. To use the new fuel, no alteration in a plane's engine is required beyond the addition of a tank-shaped vaporizer that converts the fuel into a dry gas ready for use in the cylinders and which is then exploded like ordinary fuel.



### SLOTTED SPECTACLES GUARD SKIER'S EYES

SLOTTED spectacles for skiers have been introduced in Sweden. Narrow apertures in the metal eyepieces, arranged in a fan-like design, are said to give clear vision and to avoid the necessity of blinking, as well as protecting the wearer against snow blindness, and flying particles of ice.

### BABY DRIVES ITS OWN CAR BUT NURSE CAN STOP IT



This electrically powered auto for baby can hit an eight-mile speed but nurse holds switch that stops it

PROUD owner of a miniature car that really runs is eighteen-months-old Peter Aldridge, of Offchurch, England. Driven by an electric motor, it is capable of an eight-mile speed. Should it get out of control of the driver, a nurse turns a switch at the end of a trailing cable and stops the car.

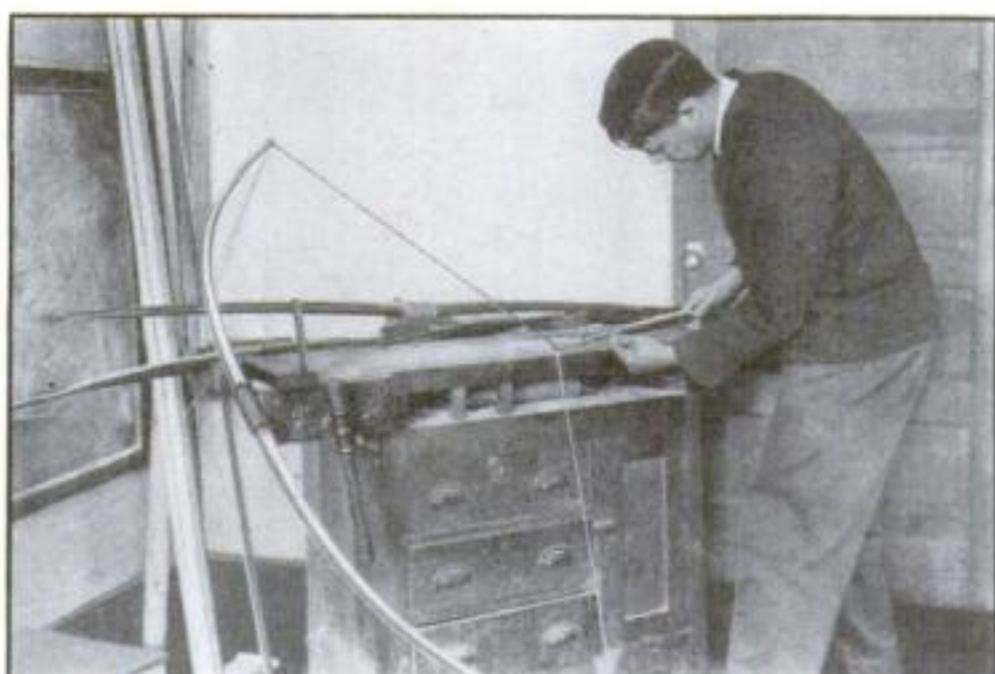


### STRIKING PHOTO OF NEW DIESEL TRAIN SWEEPING PAST AN OLD LOCOMOTIVE

SNAPPED on a British railway line, the striking photograph reproduced above, illustrates a scene that is being enacted in many countries as the old order in railroad transportation gives way to the new. A light, streamlined Diesel car at the left, with a single motorman at the controls, speeds by the regulation steam train, seen in the foreground. The more familiar equipment, with fireman and engineer working in the cab, seems ponderous and antiquated in comparison with the new.

## U. S. Scientist's Hobby Makes Him an Expert

BEGUN as a hobby, the making of bows and arrows has proved a profitable sideline for W. O. Robinson, soil scientist of the U. S. Department of Agriculture, and an amateur archer. His adventures in craftsmanship started when he decided to make his own archery outfit. Because of his prowess at fashioning bows from lemonwood and osage orange, and arrows from fir, spruce, and cedar, he has been made official bowyer of the Potomac Archers. Importers of tropical wood in New York City have standing orders to send him samples of any new varieties of rare woods they may receive from abroad, so he may test them for archery equipment. An enthusiast in other fields of woodworking and metal working as well, Robinson himself built his Washington, D. C., home and much of its furniture.



W. O. Robinson, soil scientist of the U. S. Department of Agriculture, is shown working at his hobby. He is also an enthusiastic metal worker



Commercial monoplane, built in England, attained speed in excess of 200 miles an hour in trial flights. Note grasshopper shape of its fuselage

## NEW COMMERCIAL PLANE FLIES AT 200-MILE SPEED

REPUTED to be the fastest commercial plane in Great Britain, a single-seater machine just completed at a Gravesend, England, factory is reported to have attained

a speed of more than 200 miles an hour in trial flights. Its stubby fuselage, whose profile suggests that of a grasshopper at rest, contains an enclosed cockpit set well

back toward the tail. The speedy monoplane is designed for a cruising radius, it is said, of 600 miles without the necessity for refueling.

Electric bulbs for new glow lamps are being put out in strange shapes, as photo shows



### STRANGE SHAPES MARK NEW ELECTRIC BULBS

WITH the recent introduction of glow lamps containing metallic vapors for highway lighting, new electric bulbs are taking on odd forms. A few are illustrated above. The curious lamps at the left are to be combined in lighting units with incandescent bulbs of conventional style.

### SWIMMING NOW TAUGHT BY TELEPHONE

SWIMMING is taught by telephone, in a method recently devised by a San Francisco, Calif., instructor. Wearing waterproof headphones, the pupil swims at the end of a trailing cable connecting the

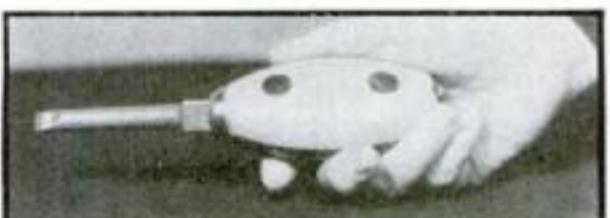
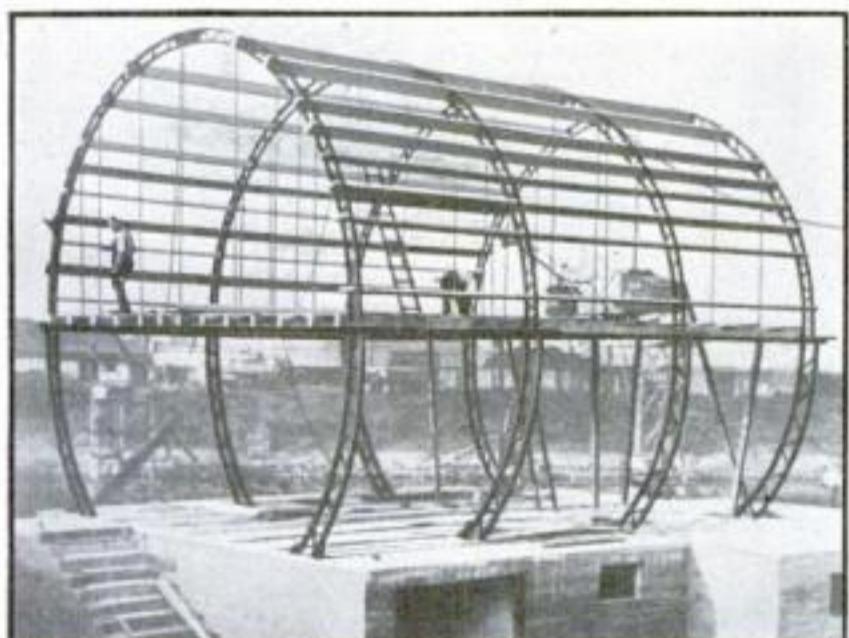
'phones with a mouthpiece in the hands of the

coach. In this way, he is able to correct mistakes in timing and in execution of the strokes at the moment they occur, instead of waiting until the novice has left the pool. A small battery carried in the hand of the instructor provides all of the current that is needed to operate the small aquatic telephone.



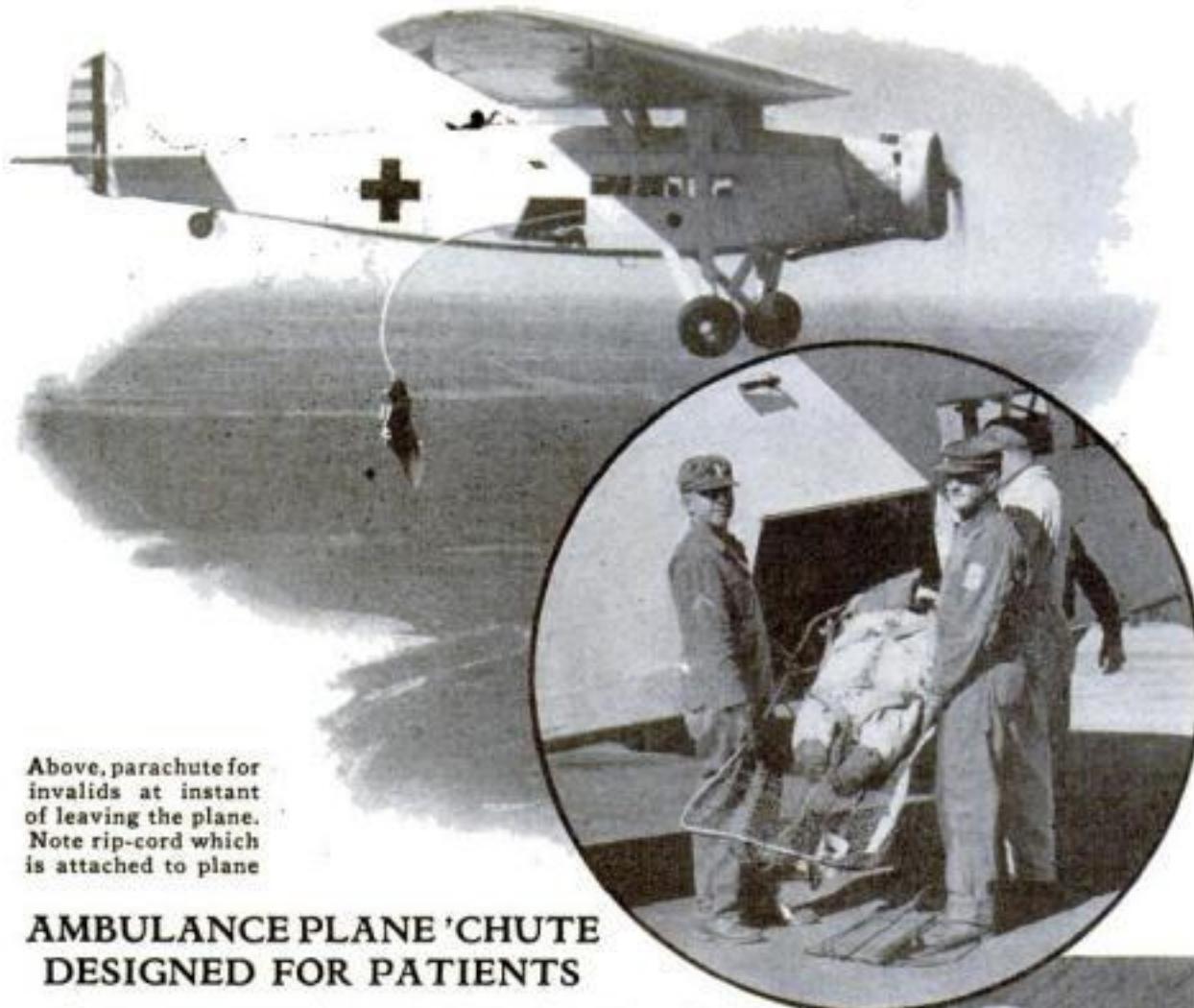
### BUILDS HOME LIKE BARREL

IMPRESSIONED by the structural strength of ring-shaped members, an inventor of Dusseldorf, Germany, is building himself a barrel house. Four circular frames, each two stories high, are joined by horizontal beams to support the walls, floors, and roof. The photograph at the left shows the unusual dwelling under construction. It was taken just after the erection of the ring-shaped members.



### OVERSIZE GRIP BOOSTS SCREWDRIVER'S POWER

PROVIDED with an oversize grip, a screwdriver recently placed on the market is declared to provide sufficient leverage to remove the most stubborn screw. The square shape forged into the shank at its base, as seen in the photograph above, permits a wrench to be applied to the screwdriver if necessary. The forging runs the entire length of the screwdriver.



Above, parachute for invalids at instant of leaving the plane. Note rip-cord which is attached to plane

## AMBULANCE PLANE 'CHUTE DESIGNED FOR PATIENTS

SO BED-RIDDEN patients can float safely to earth in cases of emergency, a new type of parachute has been perfected for ambulance planes by the U. S. Army Air Corps at Kelly Field, Texas. The 'chute was designed under the direction of Master Sergeant R. W. Bottriell, nationally known parachute expert. The new 'chute eliminates the need for a sick passenger to pull his own ripcord. An eighteen-foot cord is attached from the inside of the plane to the litter on which the patient is lying. In cases of emergency, an attendant jerks a chain that pulls the pins out of the hinges of a door on the side of the plane. Then the litter is shoved out and when the patient, strapped to the cot, has fallen eighteen feet, the ripcord automatically opens the parachute. In many tests, a dummy floated gently to earth each time.



In circle, placing litter and 'chute in the plane for a trial. Above, open 'chute on way down



## HEAVY METAL SHOE CONTROLS FIRE HOSE

TO HOLD a high-pressure fire hose, a San Diego, Calif., fireman has invented a heavy metal shoe that can be clamped near the nozzle. By placing one foot on the broad base, a single fireman can keep a hose from squirming out of control. Ordinarily the services of two or three men would be required. Other shoes have been invented in the past but they have not been widely used because they clamped the nozzle in a fixed position.

## PHONOGRAPH RECORD REPLACES CHURCH BELL

TO PROVIDE chimes for a small church, members of a congregation in Australia have obtained a phonograph record of the chimes of Westminster Abbey, in England. Powerful amplifiers broadcast the record each Sunday.

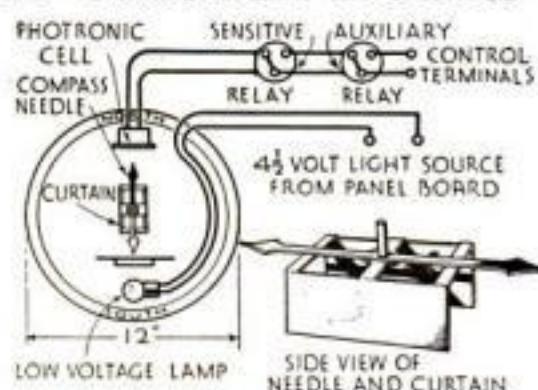


## BAMBOO SHIELD GUARDS CHINESE SKYSCRAPER

WHEN the Chinese build a skyscraper, police take a hand to make sure that none of the onlookers will get hurt. A huge shield of bamboo matting is erected around the rising building to prevent falling objects from striking passers-by, as shown above in a photograph of a 260-foot steel building now rising in Shanghai.

## BURIED SWITCH OPENS GARAGE DOORS

GARAGE doors open of their own accord for the motorist who has installed in his driveway the new type of sensitive electric switch, illustrated below. Passing over the switch, without need of actually touching it the metal frame of the car creates a magnetic disturbance that deflects a compass needle in the buried instrument. This in turn actuates a photo-electric cell, as shown in the diagram at right, and operates a relay that swings the doors ajar. The device could also be used as a burglar or kidnap alarm. In a private driveway it could be made to ring a bell at approach of a strange car.



Diagrams above show how buried switch operates photo-electric cell and opens doors. Below, arrow points to switch



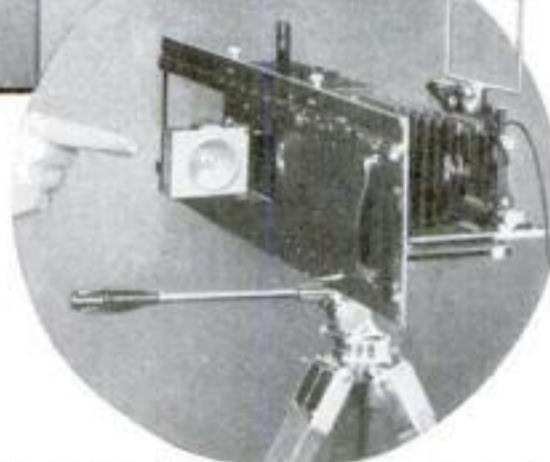
# Unsinkable Motor Boat Has Round Hull

DESIGNED to be proof against capsizing, a circular motorboat, recently launched by G. D. Ross, of Fairmont, Mo., has carried as many as seventeen persons at once in successful trials. A casual observer might be puzzled to decide which part is the front of this strange craft, which resembles a pair of tubs placed together, and has only a rudimentary bow and stern. Because of its odd shape and the buoyancy tanks in its bottom, the inventor maintains, the boat is virtually unsinkable. Made of eighteen-gauge steel, the round hull has a diameter of eight feet outside and six feet inside. A seat for passengers encircles the interior, and a section of the floor may be raised to serve as a table or bed for use on cruises. Other fittings include an icebox holding a week's supplies. Curtains of imitation glass protect the passengers from stormy weather. An outboard motor of standard make at the stern is reported to propel the boat at a fair speed, and the pilot, contrary to appearances, is said to have no difficulty in steering a straight course by means of the rudder which works as on conventional type boats.



Round motor boat, with buoyancy tank in its hull, is said by inventor to be unsinkable

## FOCUSSES CAMERA IN DARK



Flash light which helps focus camera in the dark, is shown above mounted on metal plate

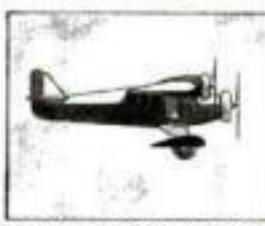
Tiny flash light, left, is directed through camera lens and throws a dot of light on object to be photographed. In this way it is easy to focus a camera in an unlighted room



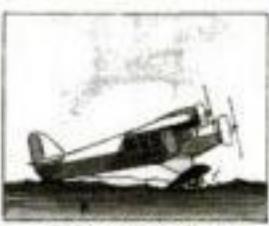
## NEW MACHINE READS BOOKS TO THE BLIND

COMPACT and portable as a suitcase, a new form of talking book for the blind, shown above, is shortly to be placed on the market. The device comprises an electric phonograph and a radio-type sound reproducer, requiring only to be plugged to the nearest household outlet for operation. Phonograph records of popular books will be available in libraries throughout the country.

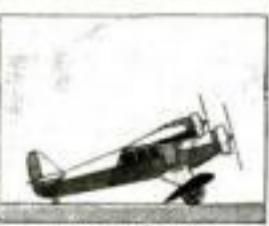
## THIRD WING ON CRASHPROOF PLANE



AUXILIARY WING



PONTOON



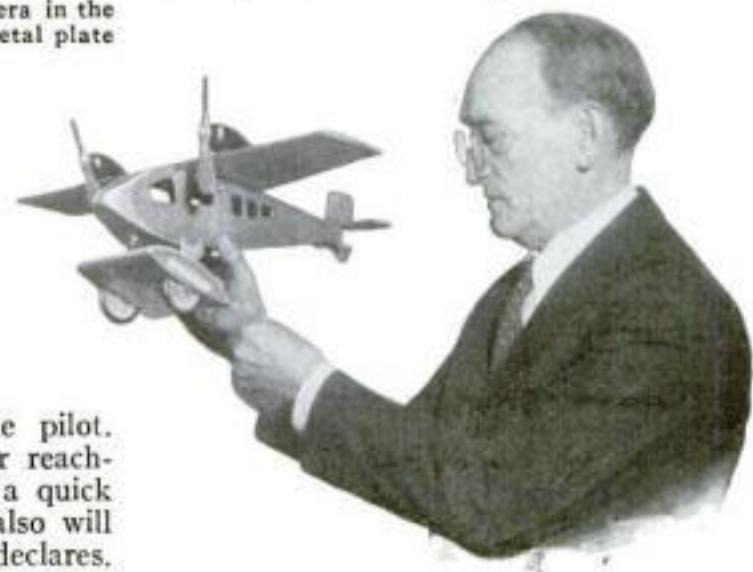
BRAKE



STABILIZER

MOUNTED on the landing gear beneath the fuselage of an airplane, an auxiliary wing devised by a New York inventor would safeguard the machine against crashes, he maintains. The pitch of the

wing may be controlled by the pilot. Thus, by inclining the wing after reaching flying speed, he may obtain a quick and positive take-off. The wing also will prevent nose dives, the inventor declares.



# Strange Wild Creatures TAMED BY MAN AS PETS

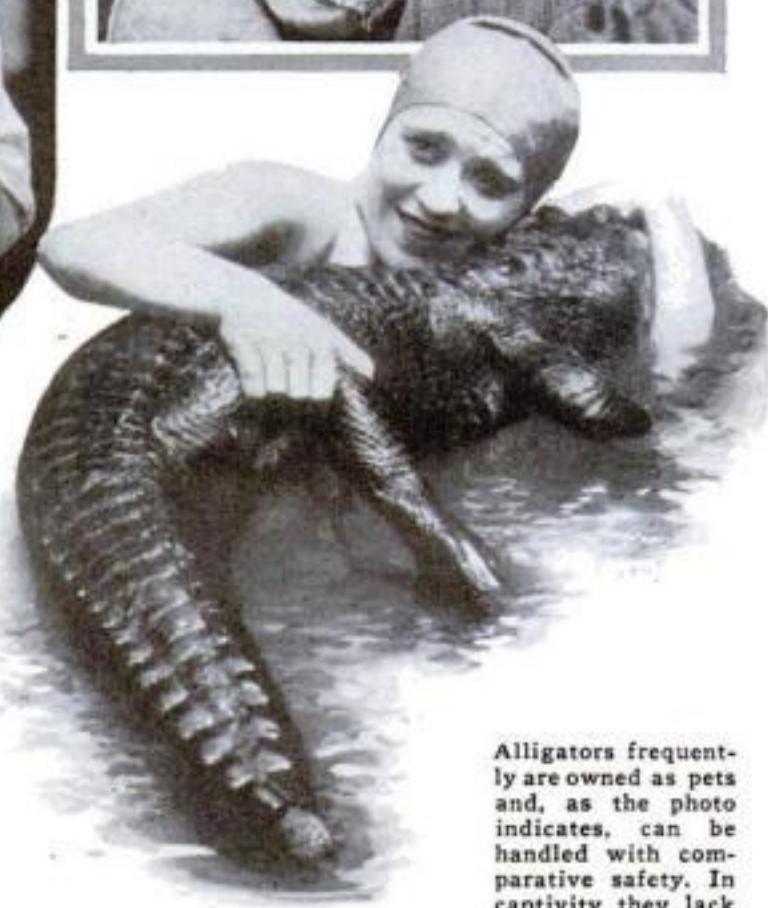


Lily Pons, opera star, with the pet ocelot she recently presented to the Bronx Zoo, New York. It belongs to the cat family

Koala mother and young resting comfortably in the arms of their owner. The koala is a tree-living marsupial of Australia



Even crows can be tamed as the picture above shows. This bird is a pet in a craftshop



Alligators frequently are owned as pets and, as the photo indicates, can be handled with comparative safety. In captivity they lack the vicious nature found in crocodiles

a pink and gray Australian bird perched on his shoulder. If the King travels, the bird goes along, riding in a covered cage borne by a special servant.

A special train takes hundreds of pets when London sportsmen go to Scotland for the shooting. There are kangaroos, wallabies, and the koala bear of the treetops, carrying its babies in its pouch. New York still has professional pet leaders who live by taking animals for an airing. Although many pets left to be boarded at pet shops are now unredeemed, Eva Le Gallienne, the actress, redeemed some quaint Java rice birds and Australian love birds, and kept them behind the scenes of Alice in Wonderland. The oldest American pet-

dealing firm, Louis Ruhe, has four buildings on a lot 140 by 600 feet at Woodside, N. Y., stocked with all manner of creatures. The Speyer Memorial Hospital in New York cared for 300,506 animals last year. At Wantagh, L. I., is a pet cemetery with 1,500 graves.

Soon there will be more strange pets than ever, thanks to a new scientific trick—hunting with a gas gun. A Cali-

By  
**THOMAS M. JOHNSON**

EARLY one morning, a few weeks ago, the green automobile of an Emergency Squad dashed away from Police Headquarters in Brooklyn, N. Y., and raced across the city on one of the queerest calls in recent years.

At 8565 Shore Road, nine chimpanzees that live in a house of their own, had been overcome by fumes from a heating stove. Both the Emergency Squad and a crew from a local lighting company answered the caretaker's call for help. Working in shifts, they lined the unconscious animals up on the lawn, slapped on pul-motors, and applied first-aid treatment. Quick work saved the lives of all except one of the pets. The chimpanzees are part of a private zoo which forms the hobby of Dr. and Mrs. William Lintz.

As far back as human records extend, pets of different kinds have fascinated man. He has derived pleasure from taming wild animals and teaching them tricks. Neolithic men tamed cattle, goats, sheep, and pigs. Early American Indians had pet cats. Aboriginal Australians kept wallabies and bandicoots. Modern pets run the gamut from snakes, toads, porcupines, and armadillos to the mouse deer and the praying mantis.

Charles Dickens worked his pet magpie into a book. Richard Harding Davis drove two snakes tandem in Bethlehem, Pa. The theatrical manager, E. F. Albee, kept two elephants. Vincent Lopez, the orchestra leader, has an alligator. Early morning visitors who meet King George at Buckingham Palace, are greeted with a raucus: "What about it?" shrieked by



This fawn, no longer afraid of man, follows its master about like a dog. When young, deer are affectionate and can be tamed easily

fornia scientist, sailed recently for Latin America to use this new means of catching exotic specimens without wounding or killing them. Simultaneously, nine nations signed a treaty outlawing hunting African wild animals from automobiles or flying low over them in airplanes.

It may sound incredible, but recently one New York pet shop in a few days sold ninety baby boa constrictors to women. Far more women than men, keep snakes as pets; usually, small constrictors, anacondas, or blacksnakes. A famous theatrical snake charmer asked Dr. Raymond L. Ditmars, curator of mammals and reptiles at the Bronx Zoo, to come and tell her how to treat a sick snake.

"Won't you sit down?" she asked motioning to a settee.

Dr. Ditmars sat down on a large cushion. The cushion moved. In fact, it reared up. It was a coiled twelve-foot python. The head of another rose from behind a warm radiator. They were quite tame. Their mistress was sure they loved her, but snake authorities say she de-

ceived herself. Almost all snakes are cold-blooded in every sense, and love only the food they get—rabbits for the larger ones, mice for the smaller. Snake charmers usually use non-venomous snakes, like boas, pythons, and anacondas. Before the depression they bought twenty-four-foot monsters; now, they can afford only twelve- or fifteen-footers.

Perhaps there is one constrictor that really likes petting and is affectionate—the beautiful black and yellow king snake. This deadly foe of venomous snakes, impervious to their poison, which crushes and then swallows them whole, really seems to like man. Miss Nellie Condon, long president of the Reptile Study Society, often kept king snakes in her apartment. They will curl in a woman's lap, like being stroked, and will wriggle sinuously over whoever strokes them. But they recognize no master, no individual.

To tame a snake, says Dr. Ditmars, who knows them well, be gentle. Don't frighten it with sudden motions or loud noises. If it gets angry, let it strike at a broom. Study its character and habits. Some men acquire uncanny knowledge of snakes.

One of the most venomous of American reptiles, the rattlesnake, is, fortunately, less aggressive than the cobra. A department-store man in Gadsden, Ala., put several rattlers he thought he had tamed, into his show window. Publicly he fed them chickens and frogs. There were always crowds watching. One day a dynamite explosion broke the window of the department store. Armed with sticks, lassoes and bags, up crept the bravest of Gadsden's police.

They tiptoed to the yawning gap that had been a window. Cautiously, they peeped in. There, coiled upon the floor, were the rattlesnakes, sleeping peacefully, bulging with chickens and frogs.

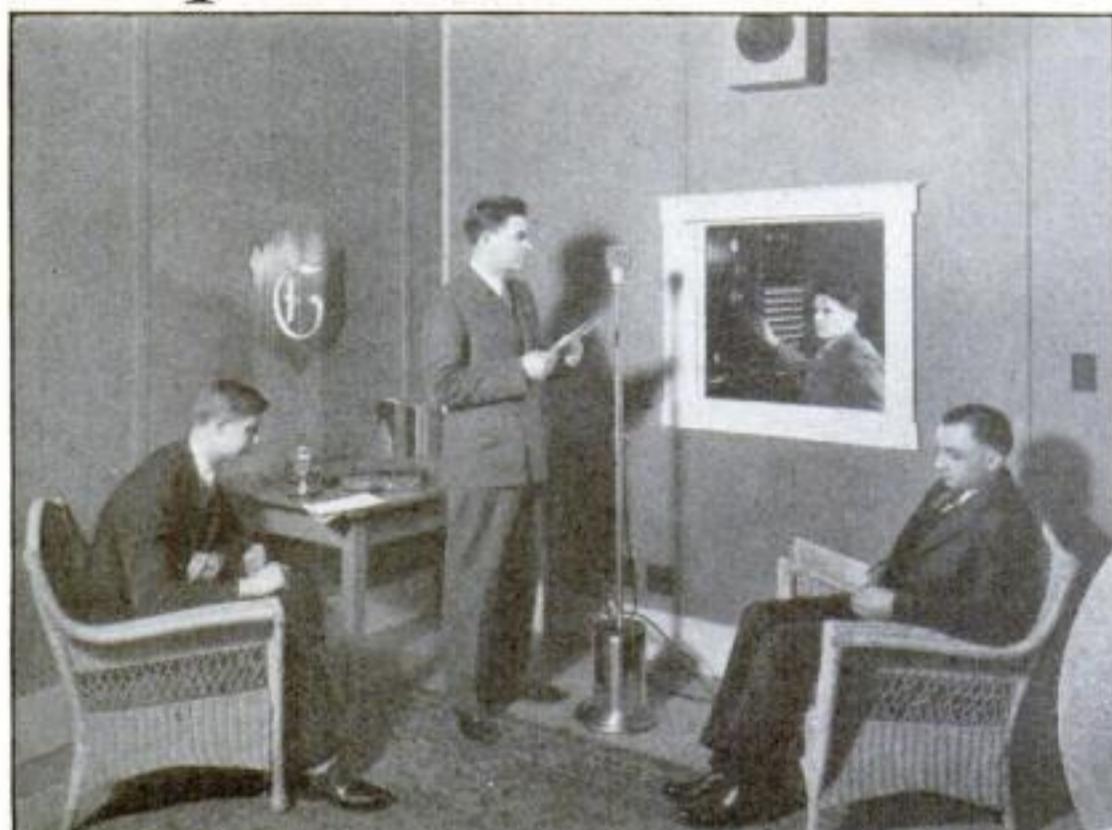
Not so the beautiful green snake that a fourteen-year-old Philadelphia girl welcomed as a new pet. Her father brought it home from a Central American banana ship for his daughter's collection. This snake would not eat. So the girl put it in a thin cardboard box, and took it to the Zoo. Dr. Ditmars gave it one look; then gently replaced the box-cover and tied it down. *(Continued on page 112)*

At right, a pet kangaroo that has made long trips in its master's plane and recently flew with him from Melbourne to London. Below, an American pet, a trained hawk owned by an expert on falconry

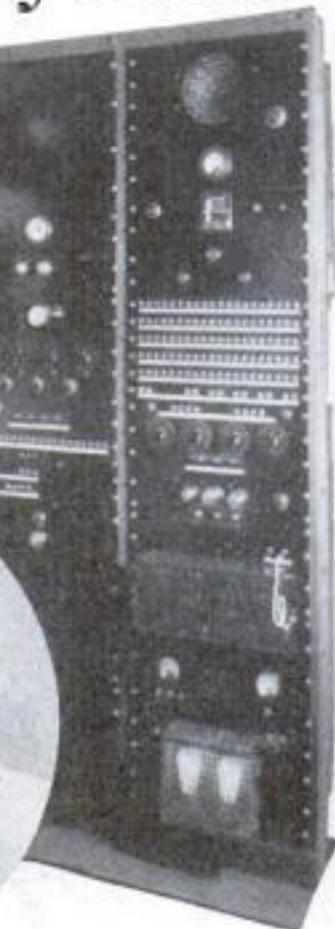


Above, a young, tame gorilla demonstrates to Mrs. Martin Johnson that it appreciates kind treatment. At right, pet agouti out for a stroll. It is a rodent that is found in Central America

# Pupils Build School's Radio System



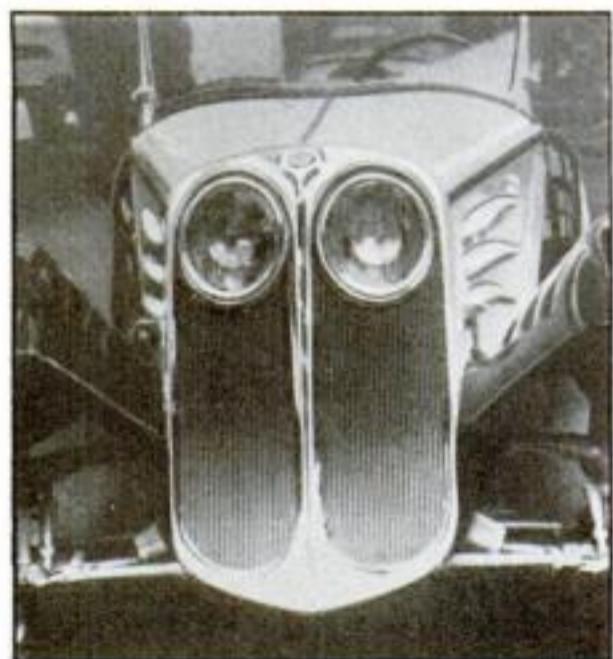
Left, Charles Hamilton, principal of Central High School, Bay City, Mich., addresses students over microphone in sound studio built by pupils. Seated, right, is Orlin D. Trapp, radio instructor, who supervised the system's installation. Right, control panel built by students. Below, phonograph and recording equipment



BUILT and operated by the students themselves, a radio and sound installation at the Central High School and Junior College, in Bay City, Mich., gives them a first-hand opportunity to learn broadcast technique. Major programs, such as performances of the school band or orchestra and a weekly address by the principal, originate in an acoustically treated studio, managed by students in a course on "radio physics." The program may be heard in any or all of ninety-five rooms provided with loudspeakers. While one of the boys acts as announcer, another in an adjoining control room watches

the performance through a plate glass window and monitors the program. The microphones in the studio are supplemented by others in twenty different parts of the school building, including the offices of the principal, assistant principal, and dean, so that the student operators may switch from one office to another for special announcements. At each of these pick-up points, a telephone connection is provided to notify the control room operator which microphone is to be put in service and what volume level is required. The system also includes a

broadcast radio receiver and a phonograph for recorded programs, either of which may be cut in as desired. Thus radio educational programs are made available to classes, while a complete musical program is always on tap for dances in the school gymnasium. To install the elaborate system, students contributed their leisure hours after school and during vacation. The system was completed in less than eight months, under the supervision of Orlin D. Trapp, radio instructor.



## HEADLIGHTS, LIKE EYES, SET IN CAR'S RADIATOR

HEAD lamps installed in the radiator of a new motor car, introduced in Germany, give the machine the curious appearance seen in the accompanying photograph. The twin lenses, sunk flush with the surface, suggest a pair of monster eyes when viewed from the front. Sinking the headlights in the top of the radiator, is in line with the general trend toward streamlining and also helps eliminate glare that, in the past, has caused many accidents on American highways.

## LEARNS LIFE WORK MAKING OUR MODELS

INTEREST in POPULAR SCIENCE MONTHLY handicraft contests led Harry Streich, farm boy of Marshall, Wisc., to a life vocation. When hard times took him from high school, he began building models from POPULAR SCIENCE blueprints. As a result of the training secured in model-making, Streich is now a successful carpenter and cabinetmaker.



Harry Streich, Marshall, Wisc., with models he built from Popular Science blueprints and thus learned his life work



## PUBLIC CALL BOX SUMMONS FIREMEN OR AMBULANCE

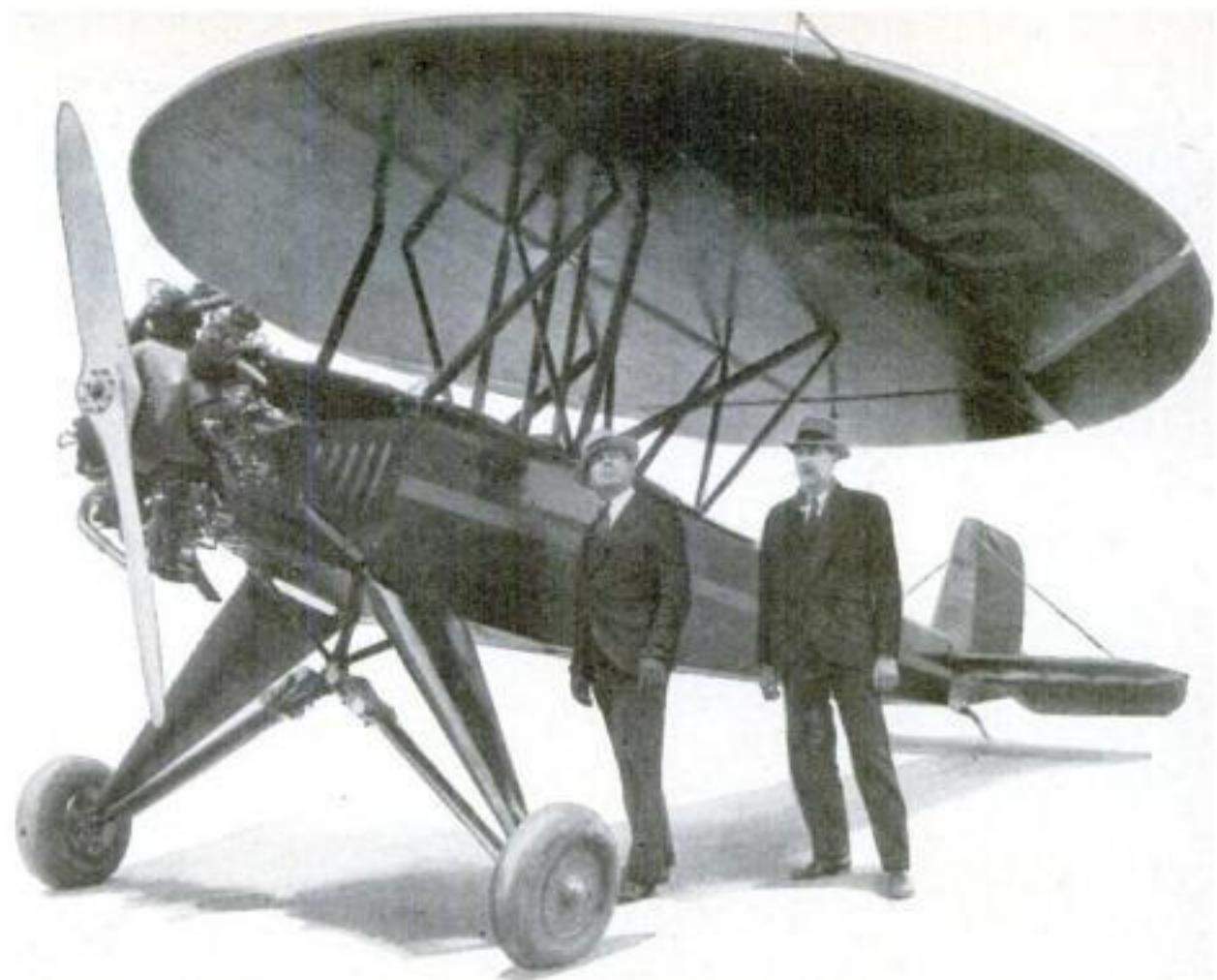
TO AID the by-stander at an accident or other emergency in getting help quickly, the city of Chesterfield, England, is installing street-corner call boxes for public use. By opening the door of the box and speaking into a microphone, any citizen may summon police, fire apparatus, or an ambulance. The innovation is expected to save the time lost in searching for a telephone. Also, because of the ease of using the call box, a witness of an accident is less likely to leave the task of calling aid to someone else.

## GUM RUBBER IN TIRES SEALS PUNCTURES

RENDERED puncture-proof by an inner layer of plastic gum rubber, a new inner tube for automobile tires, developed by an Akron, Ohio, manufacturer, may have nails driven through it without losing any air, it is said. The moment a hole is made, the plastic lining flows into the orifice and is held there by the air pressure in the tube, and according to the manufacturer, effectively plugging the leak.



Above, driving nails through auto tire in test of new puncture-proof tube. Right, a close-up of tube with gum rubber closing holes made by nails



## UMBRELLA AIRPLANE LANDS VERTICALLY

TERMED by onlookers "the flying umbrella," a new airplane with a circular wing underwent its first flight tests at Chicago the other day. By stalling the craft in mid-air, its designer, Steven P. Nemeth, demonstrated how the wing serves the pur-

pose of a parachute and enables the machine to settle almost vertically to a gentle landing. Its air speed is reported to exceed 130 miles an hour. The picture above shows the umbrella plane at the scene of the successful demonstration.

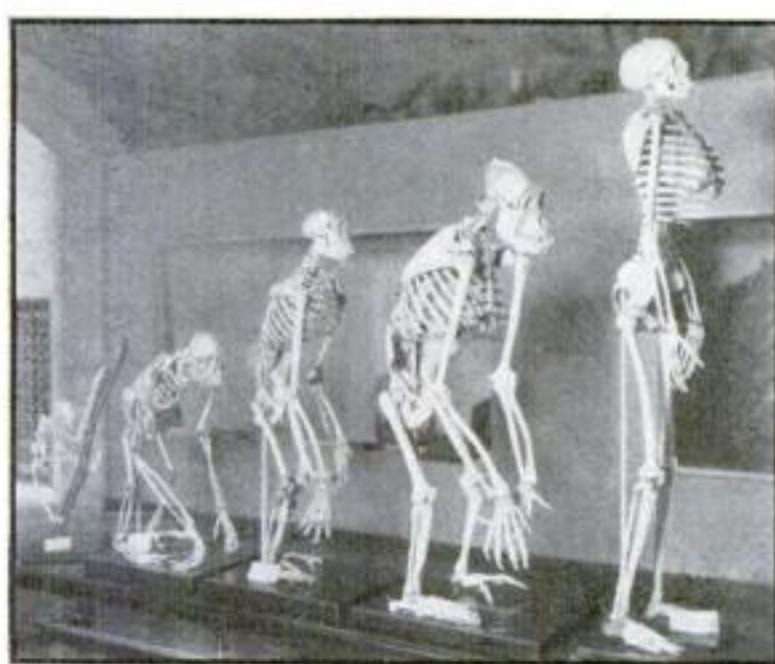
## GROWING IVY DECORATES HOTEL LOUNGE

WHEN a growing sprig of ivy pushed its way through a ventilator into the lounge of a hotel at Bradford, England, the hotel keeper took advantage of the opportunity for a bit of unusual interior decoration. By training the vine to grow around the molding of the room, as shown in the picture at right, he provided the lounge with an attractive frieze that arouses the curiosity and interest of visitors. In its new home the plant is growing very rapidly.



## STORY OF MAN'S ASCENT TOLD IN SKELETONS

GRAPHICALLY portraying the evolution of man, an exhibit at the Peabody Museum of Natural History, at Yale University, compares in succession the skeletons of a gibbon, an orang-utan, a chimpanzee, a gorilla, and a human being. The exhibit is not intended to show the actual steps in man's ascent, since it is believed man and apes sprang from a common ancestor, but gives students an idea of the process of evolution.



Instruments developed by U. S. Bureau of Standards for use in finding valuable radium needles that have fallen to the floor



## NEW INSTRUMENT FINDS LOST RADIUM NEEDLES

RADIUM-FILLED needles, such as hospitals use, are easily found, when lost, by a new instrument resembling a vacuum cleaner that has been developed by U. S. Bureau of Standards experts. By watching an electric dial as he moves the cylinder-shaped detector about, a searcher can tell when he is getting "warm" or "cold." The device replaces gold-leaf electroscopes previously used for the purpose.

# VOTING by RADIO

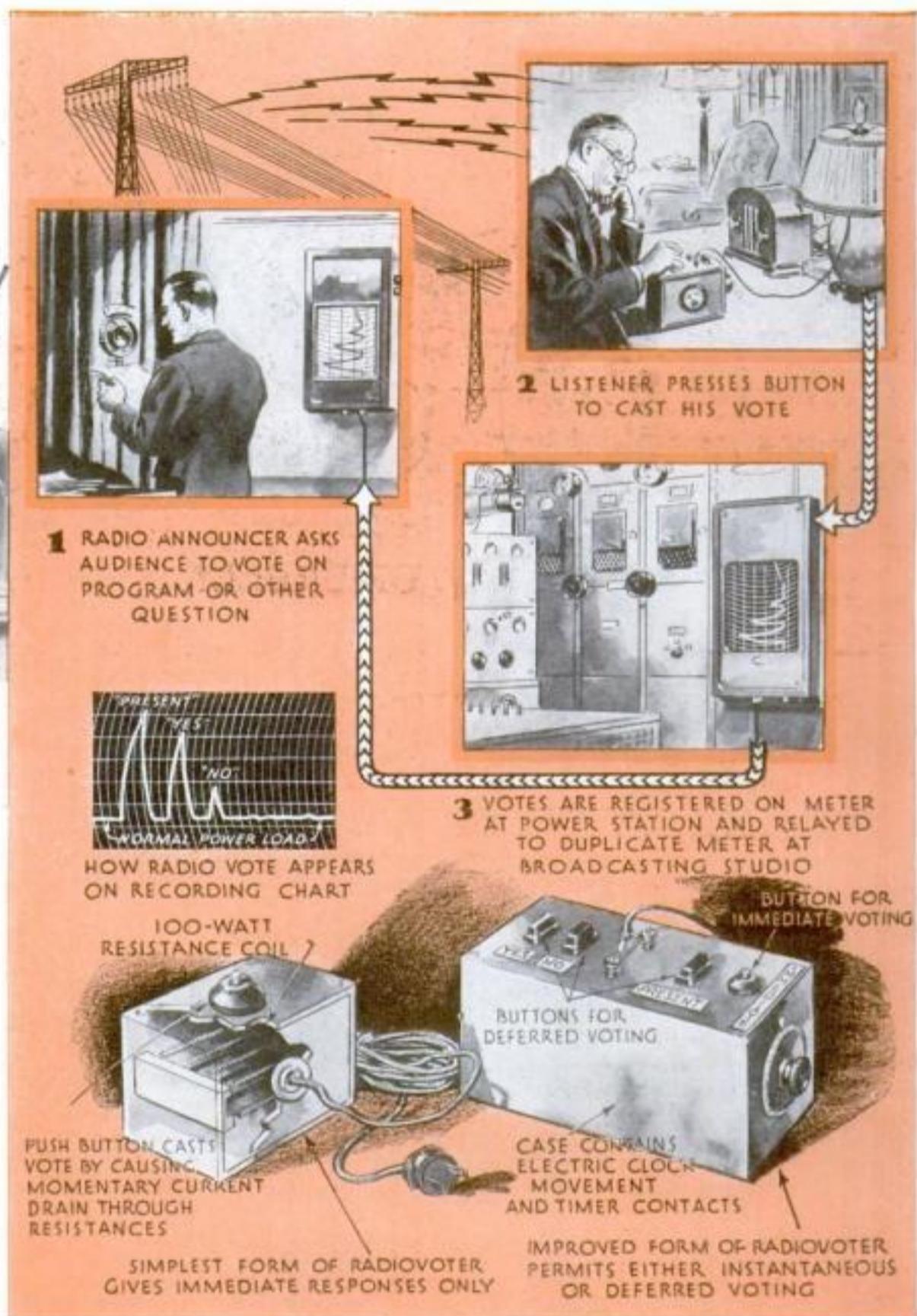


Dr. Nevil Monroe Hopkins with model of his radiovoter that enables listeners to give their opinion of broadcast program by pressing button, as is illustrated in picture at right.

*Public's opinion of programs can be recorded instantly by means of electrical impulses transmitted over power lines*

WHEN an organ recital broadcast by station WOR, Newark, N. J., ended, the other evening, radio listeners had their first chance in history to talk back to a broadcasting station and say at once what they thought of a program. An announcer stepped to the microphone and asked everyone in Hackensack, N. J., who had been listening, to turn on a forty-watt lamp bulb momentarily. A few seconds later he asked those who had enjoyed the program to repeat the act. A check-up of electric power stations serving the district produced data showing that ten percent of Hackensack's population of 60,000 had heard the program, and that ninety-five percent of the listeners enjoyed it.

In this way a crude adaptation of a remarkable radio voting system devised by Dr. Nevil Monroe Hopkins, New York radio engineer and one-time winner of the John Scott Medal for electrical research, successfully passed the first of a projected series of tests. Eventually, Dr. Hopkins plans, each radio listener will be provided with a device no larger than a cigar box, which he terms a "radiovoter." By pressing a button on this device and holding it down for an instant, the listener may give an affirmative answer to any of three questions to be asked in turn at the close of a program: Did he hear the program? Did he like it? Did he dislike it? The listener's responses are transmitted over his own electric light wires, via the power



station that supplies him with current, back to the broadcasting station, and the latter can thus find out instantly the number of listeners and their opinion of the broadcast.

In its most rudimentary form the "radiovoter" need be nothing more than a lamp, or a coil of resistance wire, which draws a small amount of current from the electric mains at the touch of a push-button switch. As thousands of fingers in thousands of homes press their buttons, a swinging pen glides across a moving chart at the power station, recording as hairpin-shaped loops, the momentary leaps in current consumption. The first loop shows the listeners "Present"; the second, the favorable or "Yes" votes; the third, the unfavorable votes, and the number and proportion of each may be gaged from

the height of the loops. Interconnected with the power station's high-speed recording meter is a duplicate or "repeater" meter in the broadcasting studio. With this instrument before his eyes an announcer can call for a vote and see the result in a fraction of a minute. Dr. Hopkins has also designed more elaborate models of his radiovoter for home use that automatically register the vote at a deferred hour such as three or four in the morning, a procedure giving certain technical advantages, and that are proof against "cheating" by turning on lamps as well.

Who will pay for the radiovoter? Its cost, which Dr. Hopkins believes will be less than a dollar, need not necessarily be borne by the radio listener. Among those who might be willing to share it, he sug-

## Radiovoter Gives Audience a Chance to Register Likes and Dislikes While Entertainment Goes on



Another radiovoter designed by Dr. Hopkins. In this system voting is recorded by circular wand shown

TRANSMITTER DIRECTS ULTRA-SHORT RADIO WAVES OVER HEADS OF AUDIENCE

AUDIENCE VOTES BY RAISING WANDS WITH BUTTONS PRESSED OR INACTIVE

PRESSING BUTTON COMPLETES CIRCUIT AND ABSORBS OR "STEALS" PART OF RADIO ENERGY

gests, are the broadcasting station itself, the radio advertisers, the electric power companies, and the manufacturer of sets.

His radiovoter, Dr. Hopkins points out, is not limited to criticism of radio programs. By its means, a radio audience could be called on for its opinion in any urgent political or social problem of the day, providing a mass straw vote, instant-

ly available at any moment, that might have a telling effect on legislation.

Supplementing, but distinct from his radiovoter, Dr. Hopkins has worked out a system for recording the opinions of audiences in theaters, public halls, and stadi-

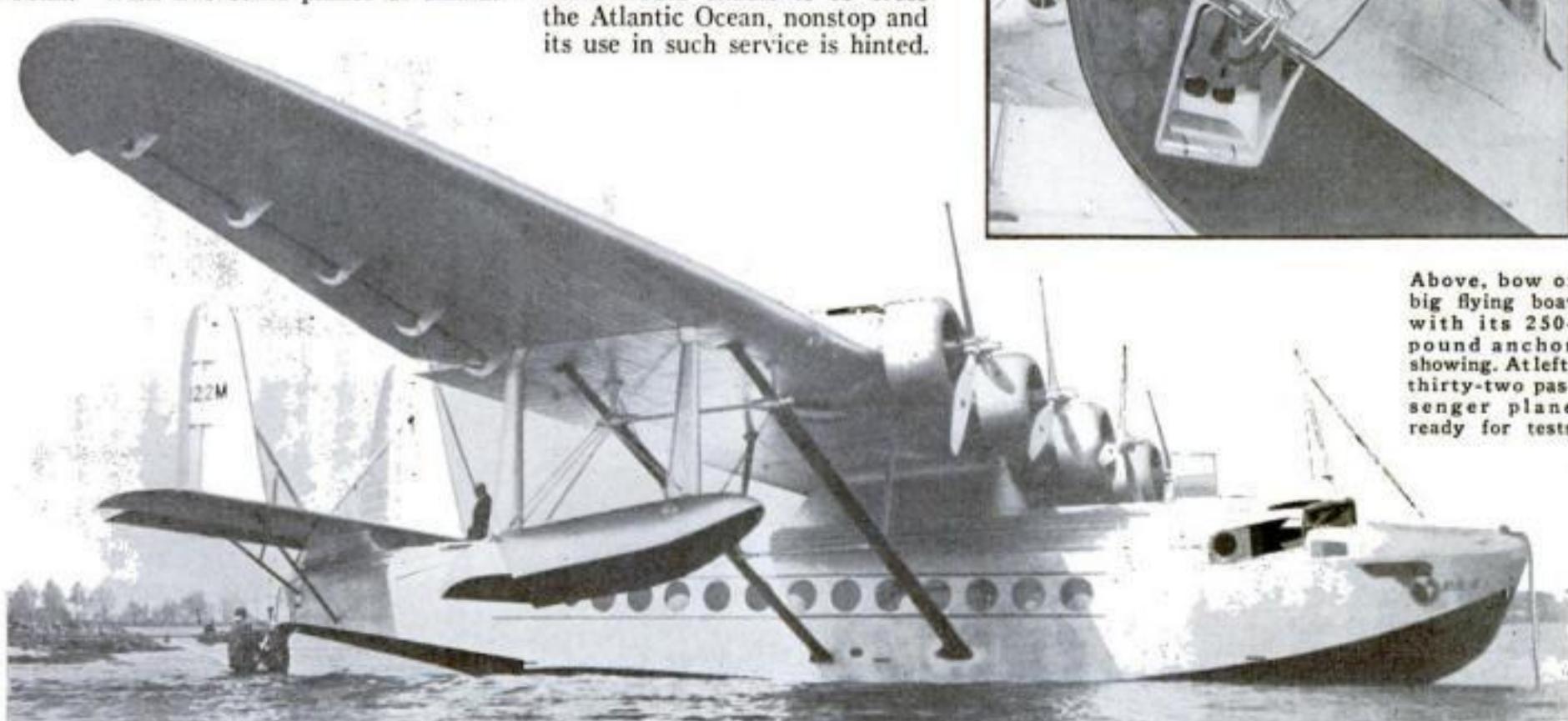
ums. A concentrated beam of ultra-short radio waves is directed over the heads of the audience, and may be intercepted by raising a wand with which each member of the audience is provided. Pressing a button on the wand completes a ring-shaped electrical circuit that absorbs or "steals" a certain part of the radio energy, the balance being picked up and registered on a recording meter that throws an image on the screen to announce the vote.

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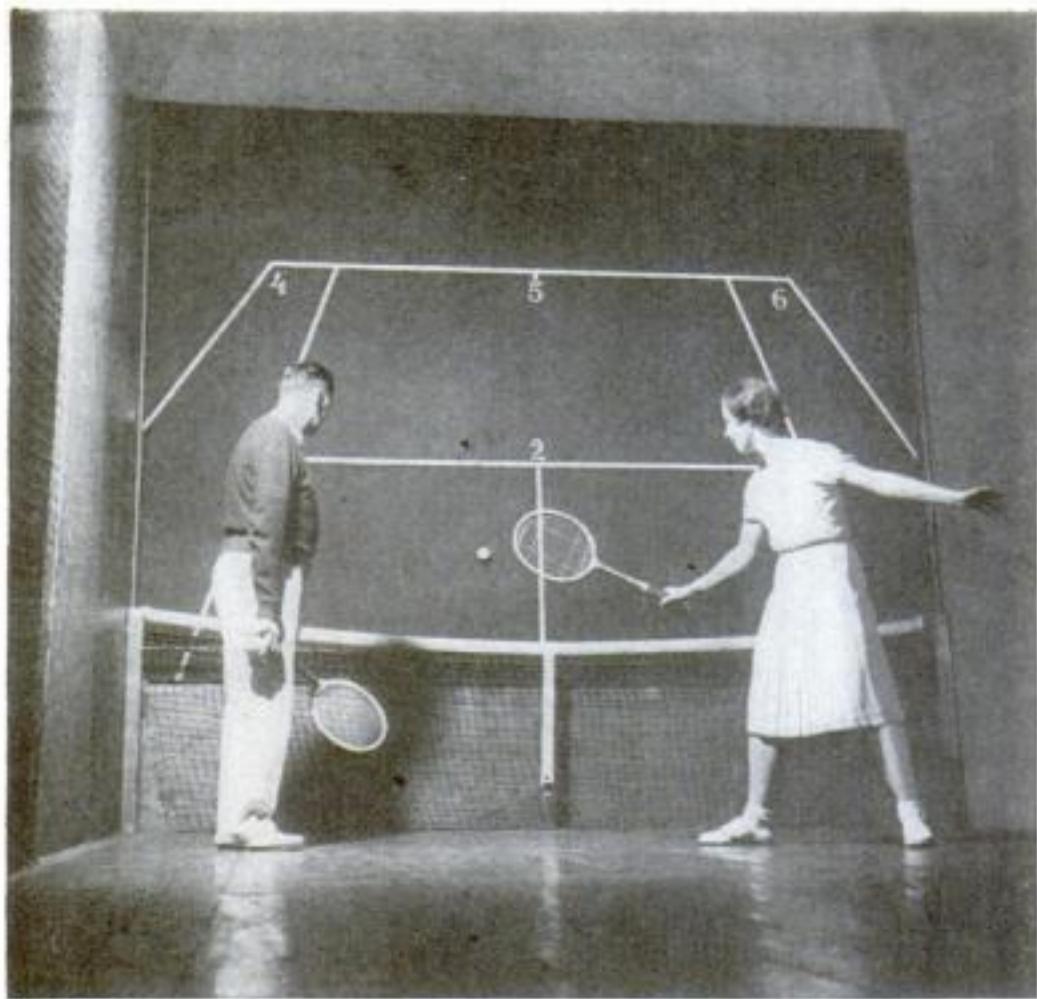
## THIRTY-TWO PASSENGER FLYING BOAT MEETS FIRST TEST

DESCRIBED as the largest airplane ever built in America, a giant thirty-two-passenger flying boat, with a wing span of 114 feet and a gross weight of nineteen tons, successfully completed its first flight tests recently at Bridgeport, Conn. With five other planes of similar

type soon to be completed, the craft will be placed in service for passenger transport between Miami, Fla., and Buenos Aires, Argentina. The 2,500-mile flying range of the four-engined machine would enable it to cross the Atlantic Ocean, nonstop and its use in such service is hinted.



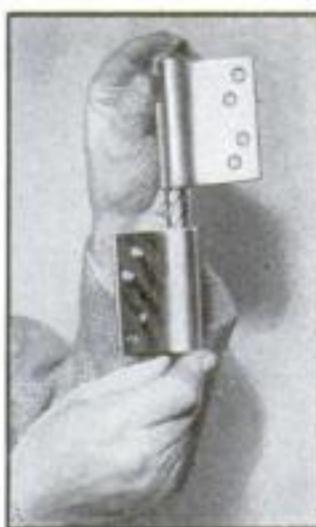
Above, bow of big flying boat with its 250-pound anchor showing. At left, thirty-two passenger plane ready for tests



Tennis court lines, drawn at an angle on a back drop, enable a player to practice with an instructor, and know where the shots are going

## IMAGINARY TENNIS COURT HELPS PUPIL LEARN GAME

PLAYING tennis on an imaginary court aids pupils to learn the game, according to a German instructor who originated the idea. For practice, the novice stands before a real tennis net and directs his stroke at a hanging back drop on which white lines are painted to simulate those of a standard court. The angles of marking, chosen according to the laws of perspective, give the vertical drop the illusion of a horizontal surface. When a ball is served from a position marked on the floor, the point at which it strikes the curtain corresponds to its actual flight on a full-sized court. In this way a pupil can play alone, the balls bouncing back from the drop.



## NEW HINGE WORKS BY DOOR'S WEIGHT

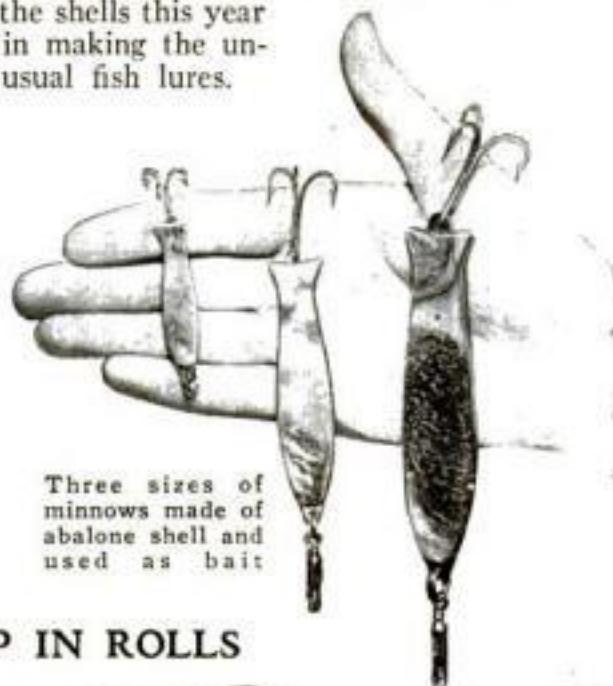
SELF-CLOSING hinges, that work by gravity alone, have been introduced by a Stillwater, Minn., inventor for use on doors and gates. A spiral groove in the connecting pin, shown at left, lifts the door as it opens, and it swings shut of its own weight. Doors thus equipped have the advantage of clearing rugs laid in front of them.

## MINNOWS FOR BAIT MADE OF ABALONE



Abalone shells, cut into the form of minnows, are polished and used as fish lures. Twenty-five tons of the shells are made up each year

MADE of polished California abalone, a new fish lure is proving popular among both fresh and deep-sea fishermen. The abalone, a food shellfish with a hard protective shell, is cut, polished and shaped to look like a minnow. The lure is made in half a dozen sizes for various kinds of fish. A California factory, whose owner discovered the possibilities of the abalone as a bait, will process twenty-five tons of the shells this year in making the unusual fish lures.



Three sizes of minnows made of abalone shell and used as bait

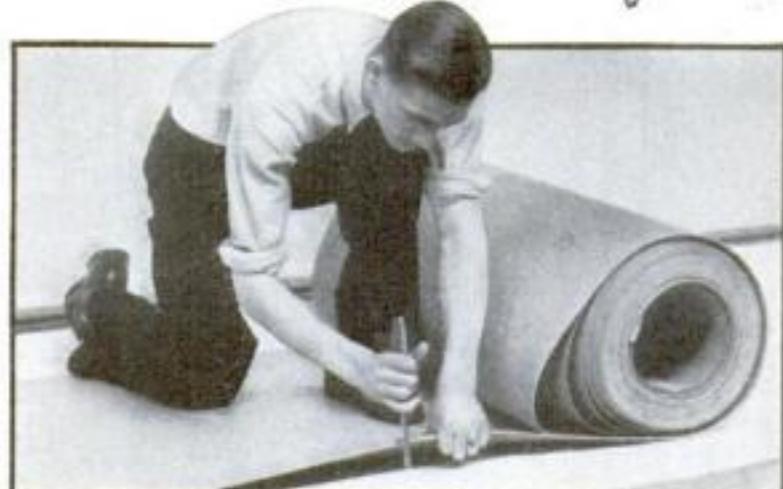


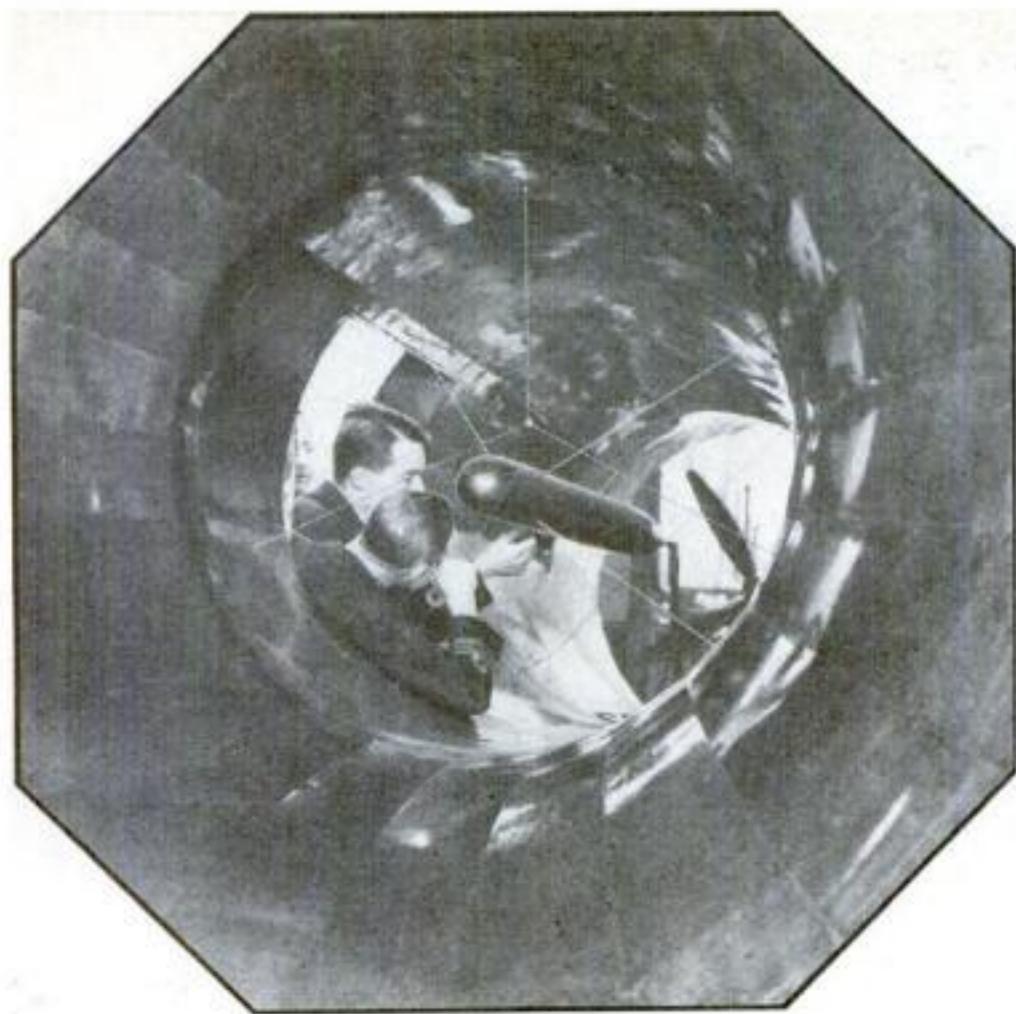
## PHOTOGRAPHER SNAPPED AT WORK ON SEA FLOOR

BY THE use of waterproof motion-picture cameras, movie studios are now obtaining close-up views of submarine ocean life to add realism to their productions. The photograph above gives a striking view of a modern subsea photographer at work, apparently as unconcernedly as if he were taking pictures on dry land. Wearing a conventional deep-sea diver's outfit, the operator sets up his camera and tripod on the ocean floor and turns on the electrically operated camera mechanism as various sea creatures approach for a look at the strange intruder.

## RUBBER FLOORING PUT UP IN ROLLS

RUBBER flooring, formerly obtainable only in sheets or blocks, is now being supplied in rolls, making it as easy to lay as other floor coverings. A fabric layer, embedded in the rubber, prevents creeping or stretching. Any good grade of linoleum cement can be used in applying the flooring, and the tools required are the same as those for linoleum. The new product can also be used on tables, desks, sink and many similar articles.





## TEST TORPEDO IN WIND TUNNEL

To aid in a study of the design of torpedoes, British naval officers have pressed into service the aeronautical wind tunnel at the engineering laboratory of the Royal Naval College at Greenwich, England. Hung on wires in the place of the airplane models that usually are subjects of test, as shown above, a torpedo is subjected to a blast of air while delicate recording instruments register the resistance or drag caused by its contour. From these tests the behavior of the torpedo in water may be computed accurately, and the design altered to provide the greatest possible speed and range for a given propulsive charge, thus increasing the weapon's efficiency.

## LISTENER'S EARS SPARED AS NOVICE PLAYS SILENT VIOLIN

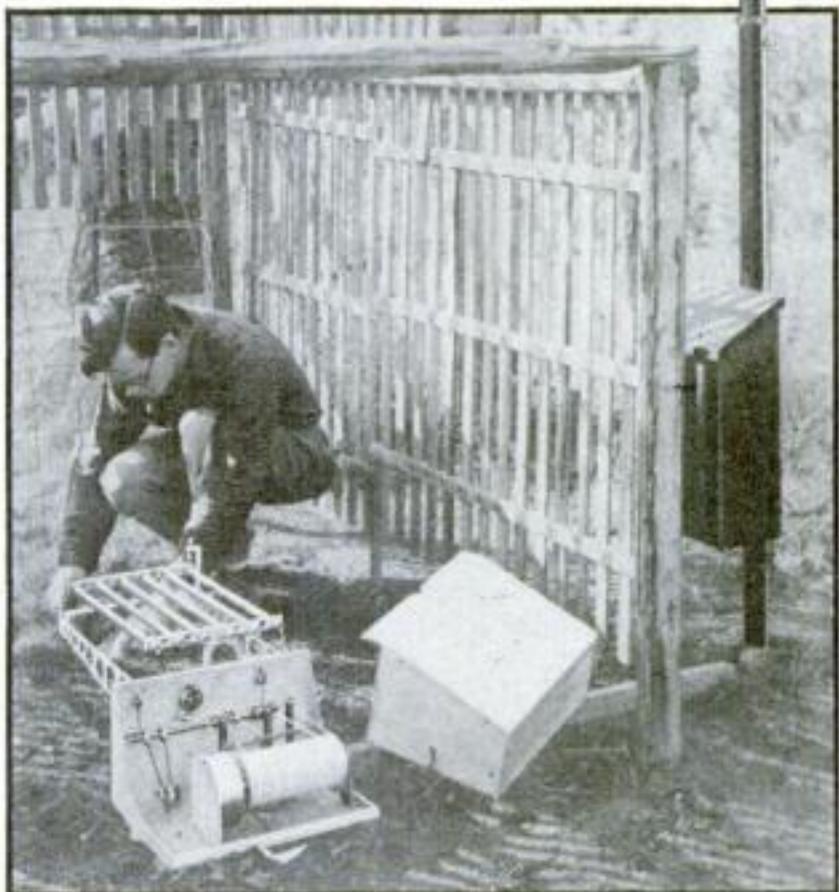
AN ELECTRICAL violin, introduced in Germany for use by those who are learning to play, spares the ears of listeners during practice hours. The instrument is devoid of a sounding box, and the tones produced by the vibrating strings are picked up electrically and conveyed to earphones worn by the player, so that he alone hears the resulting music. For use in an orchestra or by an expert player, the instrument may be connected to a loud-speaker instead of earphones. The instrument is approved by pupils and their friends.



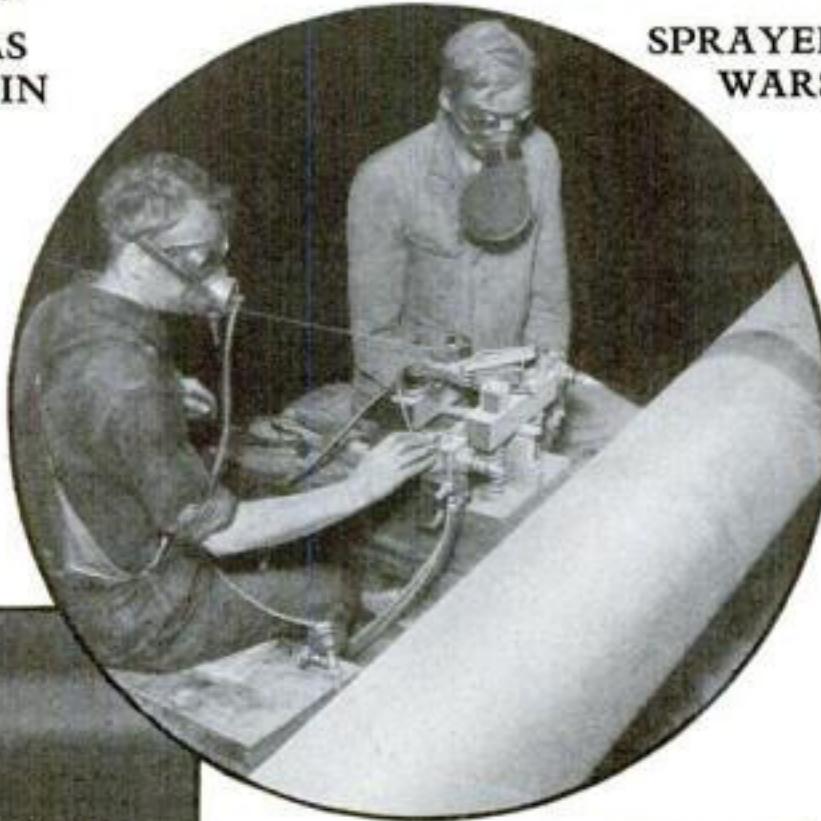
Beginner uses a violin that has no sounding box and therefore is silent to every one but the player who hears it in earphones

## FOREST FIRES PREDICTED WITH AID OF NEW MACHINE

FOREST fires can be predicted by means of a device that reveals the conditions favorable to their occurrence. The instrument has been developed for use by the U. S. Forest Service. It keeps a continuous record of weather data and the humidity of brush and leaves. This information is traced by automatic pens upon a moving paper chart.



Upon a moving paper chart, automatic pens record a continuous report of forest conditions and make possible fire predictions



Spraying cadmium on warship's tail shaft

## SPRAYED METAL GUARDS WARSHIP'S TAIL SHAFT

BLOWN on in the form of a molten spray, an armor of rustproof cadmium metal now protects from corrosion by salt water the two twenty-one-foot tail shafts that drive the screws of the U. S. S. *Henderson*. Applying the recently developed process of metalizing described not long ago in this magazine, the job was watched with interest as the first of its kind. With the aid of two guns set up on a tool post, as shown at left, a coating of metal about .032 of an inch thick was applied to the shafts in thirty-three hours. Each shaft received 165 pounds of metal.

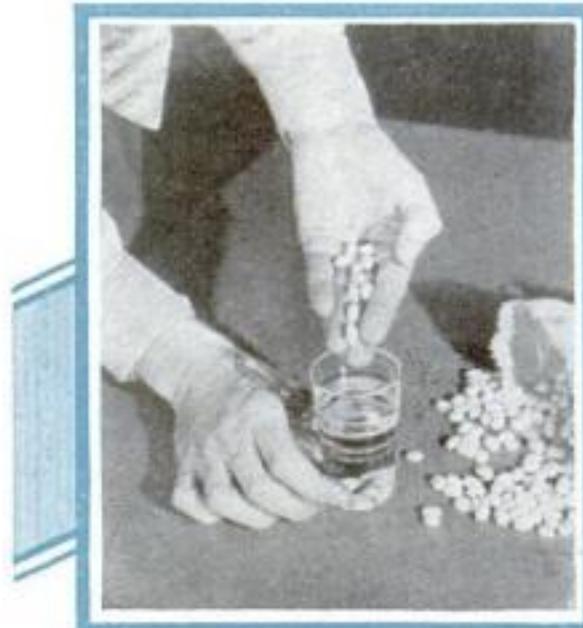
## NEW PAPER CUP EQUIPPED WITH HANDLE

COFFEE and other hot liquids may be served at picnics, without danger of burned fingers, in a new style of paper cup recently placed on the market. The cup is provided with a substantial handle, enabling it to be grasped firmly without causing it to collapse and spill its contents. The handle, of paper, is molded to the cup.



New style paper cup has heavy handle securely molded onto it

# Hidden Beauties of SPRING *revealed by your Microscope*

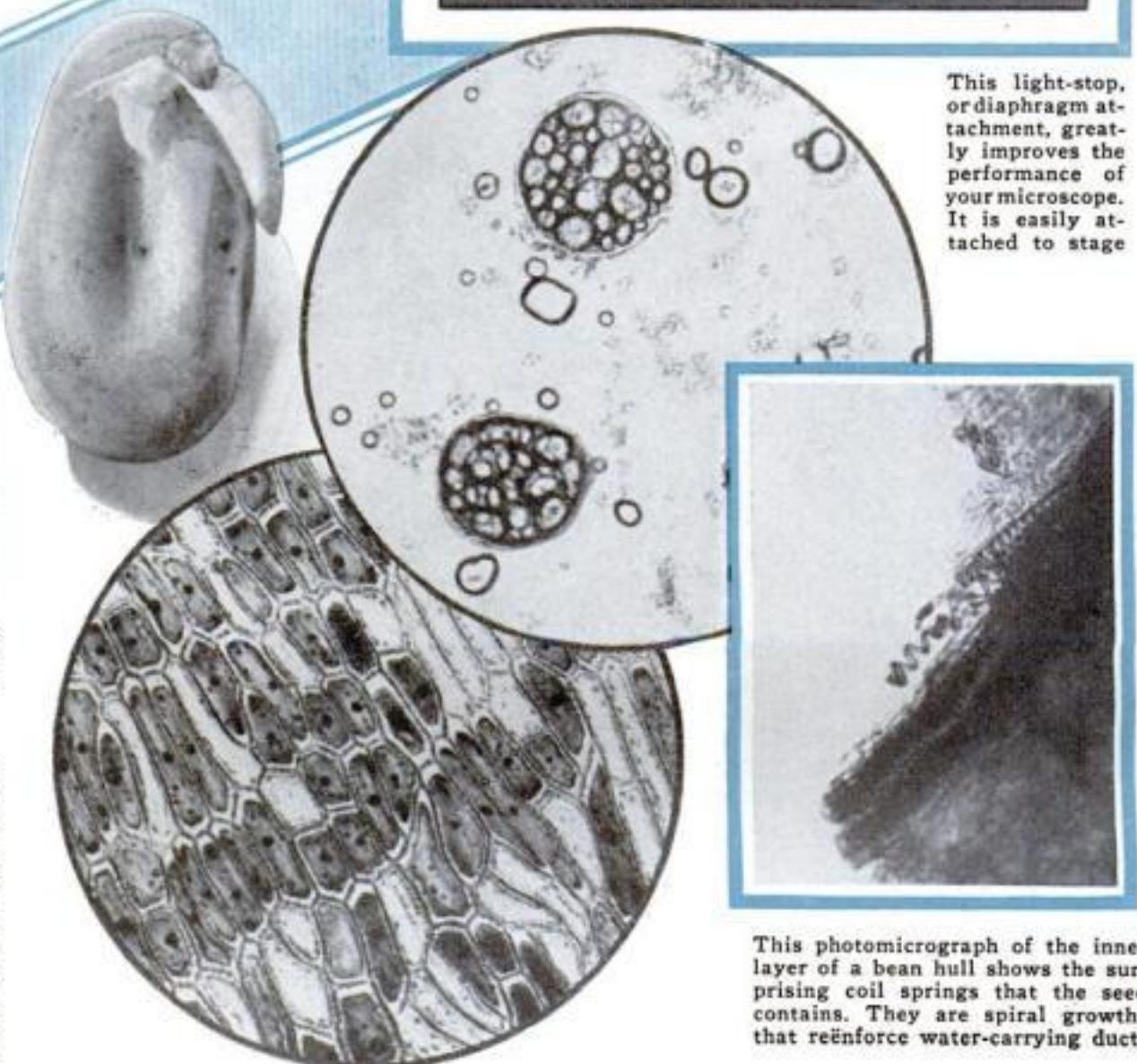


Above, beans are placed in water to soak for a day before they are placed beneath your lens. Upper right, bean cotyledon

THE sun is shining warmly, trying to erase the effects of the gentle shower that fell this morning. The gardener is planting beans, the kind that are delicious when baked with brown sugar and pork. Beans! That's an idea. Beg a few from him, and hurry back to your microscope, for a number of surprises await you. Fortunately, the gardener has soaked the beans for a day in water, so that they will sprout sooner. That will make them easy to dissect with your razor-blade scalpel.

Examine a bean first with a hand lens. Most prominent of its outside features are the scar where it was attached to the pod, and a tiny hole near the scar. With your scalpel, cut a small square from the outer covering. You find it is attached loosely to the inner portion. The covering is in two parts. Without much difficulty, you can peel from the inner surface a thin membrane. Mount this membrane and the outer portion in water, under a cover glass.

Look at the outside surface of the covering. It has a cobblestone appearance produced by nearly round cells joined to-



Upper circle, magnified section of bean cotyledon showing two large cells containing starch and around them grains of starch from broken cells. Above, mosaic of cells found with lens in cotyledon membrane

gether in a single layer. At higher magnifications, you can see that each cell has a pebbled surface.

Now turn the piece of bean covering over. You see the same general arrangement of cells and, immediately above them, another layer that contains numerous angular bodies suggesting crystals. Maybe they are crystals, for most plants contain crystalline substances. Remove the cover glass, hold the piece of bean skin firmly with tweezers and, with a

needle, scrape the inner surface until you have torn some of the cell structure apart. Add a drop of water and replace the cover glass and place the slide on stage.

Set your microscope for about 100 diameters, and carefully search the area under the cover glass. You see a tangled mass of fibers, and isolated groups of cells and . . . Hello! here's something! It's a tiny crystal, a jewel-like prism about twice as long as it is wide. And here's another! A pair of crystals, in fact, joined together at their ends so they look somewhat like an elbow in a rain-spout. These probably are crystals of



This light-stop, or diaphragm attachment, greatly improves the performance of your microscope. It is easily attached to stage



This photomicrograph of the inner layer of a bean hull shows the surprising coil springs that the seed contains. They are spiral growths that reinforce water-carrying ducts

# Mysterious Secrets of Nature Found with Ease in the Sprouting Seeds and Opening Leaves when You View Them Beneath a Lens

By  
**MORTON C. WALLING**



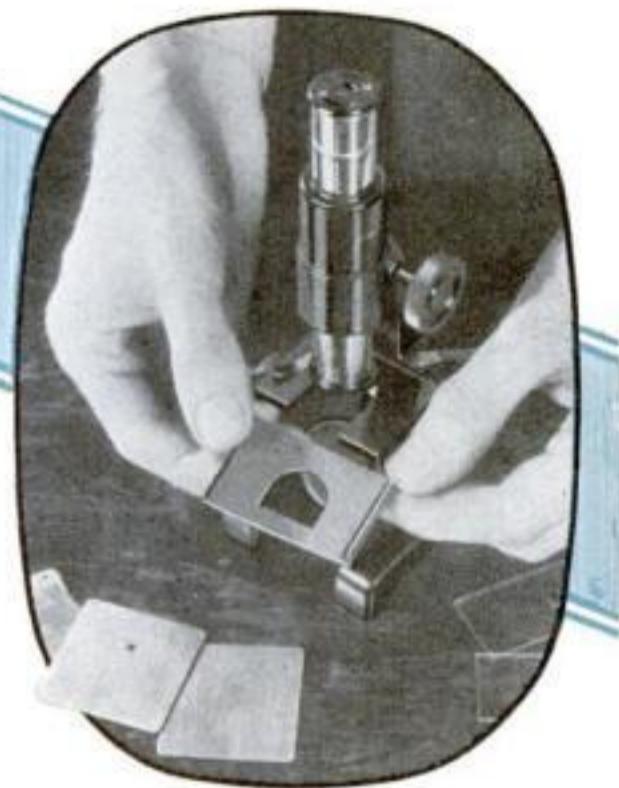
Begonia plant that furnishes many specimens like one at its right showing vein that runs through the leaf



Above left, one of the many forms of plant hairs. This one is from a begonia leaf. Above right, cutting slices from begonia leaf for microscope study. It is in specimens like this that crystals are found



HOW TO PREPARE AND VIEW YOUR PLANT SPECIMENS



Attaching stop-holder to microscope stage. The stops, two of which are shown, produce a sharp image by cutting out surplus light

carbonate of lime secreted by the vegetable. So the bean has been hiding something from you, and from everyone else who does not have a microscope! Crystals, like those you have seen, and in numerous other forms, can be found in the tissues of many other plants.

But this is only the beginning. There still remains the membrane you peeled from the inside of the bean hull. Under the microscope, you find that it is thicker than you suspected. The cells are not very well defined, but here is something that reminds you of a river system as pictured on geography maps. Small branches unite into a main stream that winds across the microscope field. Follow it to the edge of the piece, and you find a collection of coil springs! Springs as perfect as if they had been made on a machine, as a higher magnification will reveal. And there are a great many of them. Now trace the wavy path of the main stream back more carefully, and follow to the end of one of the branches. You find that a great many springs run parallel to each other until a spot is reached where some of them branch off in a different direction.

These springlike formations are the markings along the walls of the ducts; and the ducts, as their name indicates, are

long cells that operate in exactly the same manner as a sewer or water-supply system, carrying food-laden water to the cells of the bean. So, when you call them streams, you are not far from the truth. But why the springs? They are for the purpose of stiffening the walls of a water-carrying duct which are so thin that they could not retain their shape if unbraced. Thus the water, in traveling along a duct, can seep out through the thin wall spaces between the springlike coils. You will see this spring formation frequently in roots, stems, leaves, and other plant parts. Also you will find ducts with wall braces that take forms other than spirals.

Remove the remainder of the cover from the bean. You find the kernel formed of two halves, the cotyledons. Split them apart, and you discover, nestling snugly between them at one end, a tiny plant, its two leaves plainly visible to the unaided eye. This is a real bean plant, sleeping in the midst of its temporary food supply, and waiting the coming of moisture enough to enable it to grow into a full-fledged plant. The soaking that the bean was given has aroused this tiny plant into action. Already the hypocotyl has started to unfold from one end of the bean, like a trigger, and to push against the shell to break it. Remove the tiny bean plant

and examine the leaves. You find them made up of cells, with veins running through them. Slice the hypocotyl into thin sections, and you find a distinct cell structure. At the tip is a group of sturdy cells that later develop into roots.

Now for the biggest part of the bean, the pair of cotyledons. Roll one of the halves between your fingers, pressing firmly, and you discover that there is a thin membrane covering it. Peel a bit of this membrane from the flat side, and look at it at seventy-five or one hundred diameters. An amazing array of cells, each considerably longer than wide, greets your eyes. Now work a bit of magic by removing the cover glass and adding a drop of methylene blue stain. Let it act for a minute or two, then rinse the specimen in clear water. Now look at it again. It would be difficult to find anything more beautiful. You see the cells brilliantly outlined, their stained contents showing much more prominently than before. No designer of linoleum or maker of mosaic tiles ever created anything more nearly perfect or so beautiful. Try other stains. Each will produce a different picture, but one that is always beautiful.

Here's something, over at one end of the bit of tissue, that you had not noticed before. In a group of tiny baskets, massed so closely that they touch each other, are hundreds of little round objects, smooth for the most part but each with a crease running through it. You think of eggs in a basket, for many of them are shaped much like an egg. Place a drop of weak

*(Continued on page 105)*

# Mail Addressed by Gridiron Lines

*New Postal System Calls for Elimination of Names of Cities, Streets, and States*



TWO NUMBERS SUCH AS: '347.002-753.004' WILL LOCATE AN ADDRESS WITHIN ONE SQUARE YARD

NUMBERS would replace the names of states, cities, and streets, in a remarkable grid addressing system proposed by Major T. W. Battin, U.S.A., of Philadelphia, Pa. Based on a plan now in military use, his scheme would reduce an address as complicated as, "Mr. J.



Hartman, Red Hill School, New Oxford, Adams Co., Pennsylvania, U. S. A." to the simple expression, "368.9-751.2 J. Hartman." It calls for subdividing the United States by a system of north-south and east-

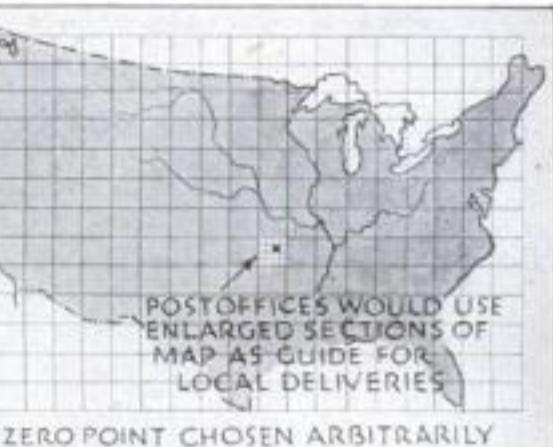


Diagram of the United States divided into large and small squares to facilitate the handling of mail under grid system

west lines, numbered in sequence from a zero point arbitrarily chosen for convenience, as shown in the accompanying illustration. Thus a person's mail address would be determined automatically and permanently by the geographical location of his home, and would be given by citing the two numbers representing the nearest north-south and east-west lines. The designation "347.002-753.004" would locate an address within one square yard, while to simplify the numbers, locations could be given to within 100 or 1,000 yards in sparsely settled districts. Such a system, Major Battin maintains, could gradually replace the present one without interfering with it. Place names would disappear except where retained for political or sentimental reasons. Standard government cards and envelopes, like the one illustrated, could be supplied and addressed with a hand punch.

## SEA CASTS UP FORTUNE IN AMBERGRIS

CAST up on the California shore, lumps of the rare substance known as ambergris recently brought unexpected wealth to their lucky finders, and started a miniature prospector's rush to the beaches. The haul netted between 200 and 300 pounds of the odorous gray substance, which is used in expensive perfumes to "fix" other scents and has sold at times for more

than twenty-six dollars an ounce. No satisfactory substitute for it has been discovered. For centuries the origin of ambergris was unknown, but in recent years it was discovered to be secreted occasionally by sperm whales, apparently as the result of some mysterious malady.



EVEN the time-honored practice of stirring paint with a stick may become old-fashioned, with the introduction of metal paint paddles designed especially for the purpose. The tools, one of which is shown above, are made of non-rusting metal and are declared to be indestructible.

## STRATOSPHERE ROCKET HAS AUTOIRO BLADES

A STRATOSPHERE rocket that lands like an autogiro is being tested by an eastern inventor. A small model has already been completed for preliminary research. The four blades, which form the landing equipment and will break the fall of the rocket, are located at the nose of the apparatus. As the rocket shoots upward, the blades are held in a collapsed position along the sides of the projectile. When the speed slackens and air resistance decreases, springs force them upward. As the rocket descends tail first, the spinning blades will check the speed.



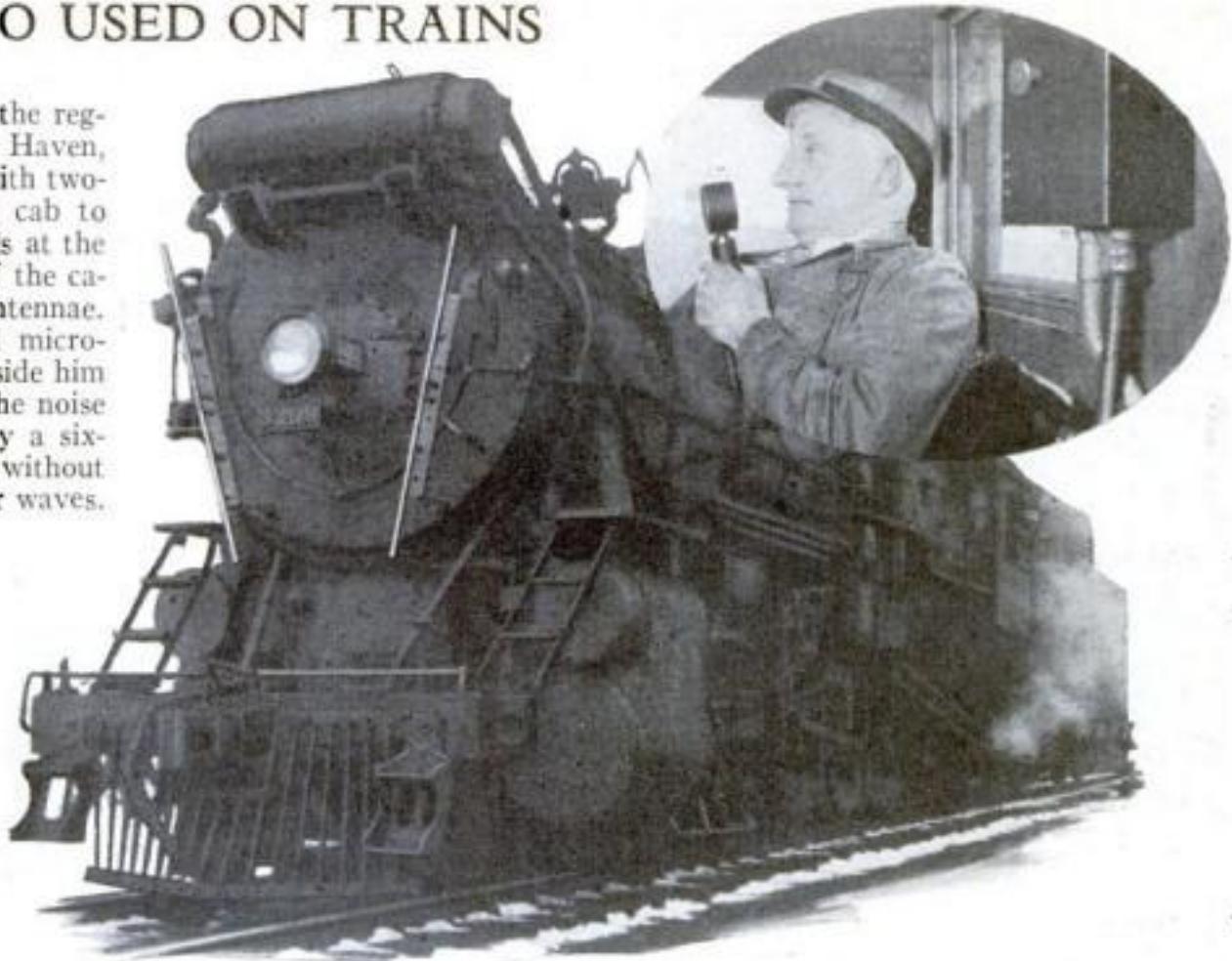
## SHORT-WAVE RADIO USED ON TRAINS

USING a newly-developed system, one of the regular freight trains of the New York, New Haven, and Hartford Railroad has been equipped with two-way radio permitting the engineer in his cab to talk with the brakeman in the caboose. Rods at the front of the locomotive, and at the sides of the caboose, serve as transmitting and receiving antennae. The engineer presses a button on a hand microphone to start the set, and a loudspeaker beside him gives sufficient volume to be heard above the noise of trains. Power for the set is provided by a six-volt battery that gives thirty hours' service without recharging. The new system uses five-meter waves.



CHEESE NOW  
RIPENED IN  
CONTAINER

BY APPLYING a trick of the wine maker to the science of packing cheese in cans, experts of the U. S. Department of Agriculture have found a way to preserve its natural flavor and make it available to the housewife in handy and attractive form. The cheese is allowed to ripen in the can in which it is sold, the normal gases of fermentation escaping through a one-way valve in the lid, shown above, that permits no air to enter. This is a principle long employed in wine making. The longer the cheese stands, the sharper its flavor.



New Haven freight train equipped with recently designed short-wave radio outfit that permits two-way conversation. In oval, brakeman in caboose talks to engineer over his transmitter

## MODEL SHOWS LONDON'S BURIED LAKE



TO AID in planning a restricted building area in London, England, engineers have just completed a five-foot model of one of the city's strangest features. This is a subterranean lake, long unsuspected and only recently discovered, twenty-six feet beneath the city's central telegraph office. The lake is estimated to be at least sixteen feet deep. To show how its presence might affect building plans, the scale model was constructed with a removable top.

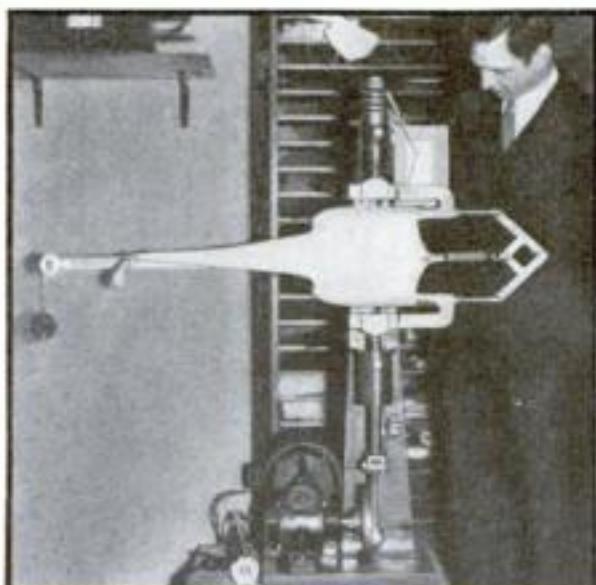
## SLEDS CARRY FISH NETS OUT TO SEA

SEAGOING sleds, made of planks and poles, help fishermen of Stelford, England, to carry their gear between dry land and the fishing grounds two miles offshore. This unusual equipment is made necessary by the soft mud at the bottom of the shallow

water through which they wade. So treacherous is the footing that each man leans upon his sled for support, making his way forward on the tips of his toes and pushing ahead of him the sled upon which is loaded his nets, weights, and baskets.



Fishermen pile their gear on homemade sleds which they push through mud to fishing ground



## TEST SILK STOCKINGS

REPRODUCING the strains placed on a silk stocking in walking upstairs, a mechanism designed by experts at the U. S. Bureau of Standards, in Washington, D. C., is testing hose in the manner shown above. While a weight pulls outward on the toe, jaws inside the top of the stocking expand at regular intervals, stretching the silk.

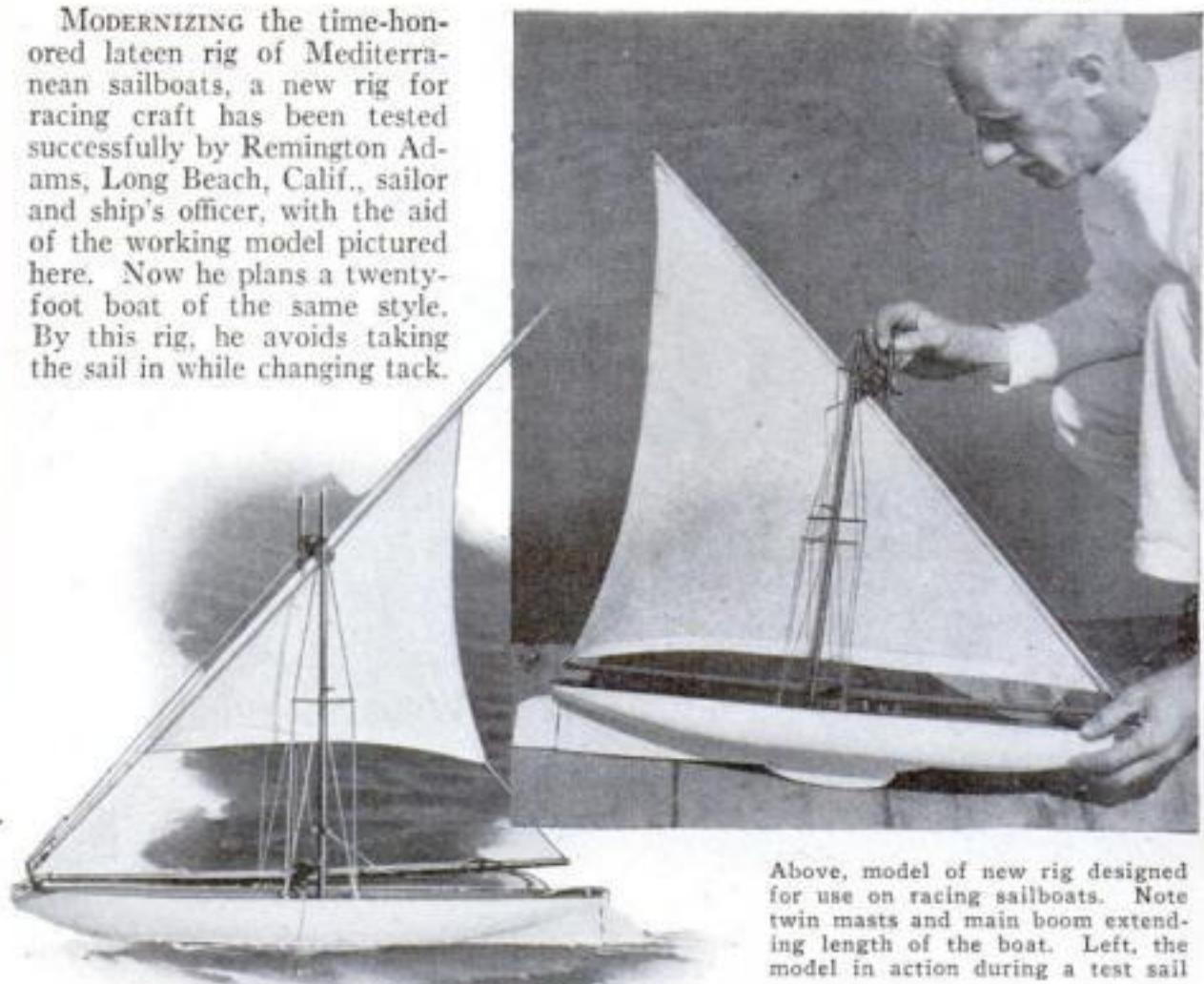


### USE GIANT FIGURE AS AD FOR TELEPHONES

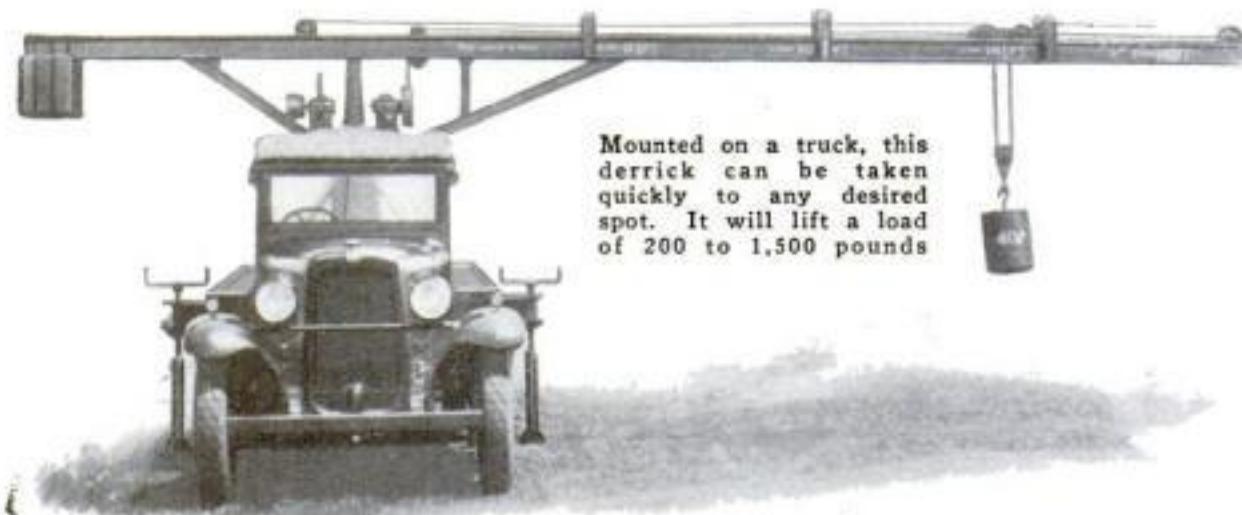
TO POPULARIZE the use of telephones, a Mexican firm has erected in Mexico City the monster advertising dummy pictured above. Straddling a street, the figure holds headphones in which is concealed a radio receiver that broadcasts music.

### TWIN MASTS GIVE SAILBOAT NEW RIG

MODERNIZING the time-honored lateen rig of Mediterranean sailboats, a new rig for racing craft has been tested successfully by Remington Adams, Long Beach, Calif., sailor and ship's officer, with the aid of the working model pictured here. Now he plans a twenty-foot boat of the same style. By this rig, he avoids taking the sail in while changing tack.



Above, model of new rig designed for use on racing sailboats. Note twin masts and main boom extending length of the boat. Left, the model in action during a test sail



Mounted on a truck, this derrick can be taken quickly to any desired spot. It will lift a load of 200 to 1,500 pounds

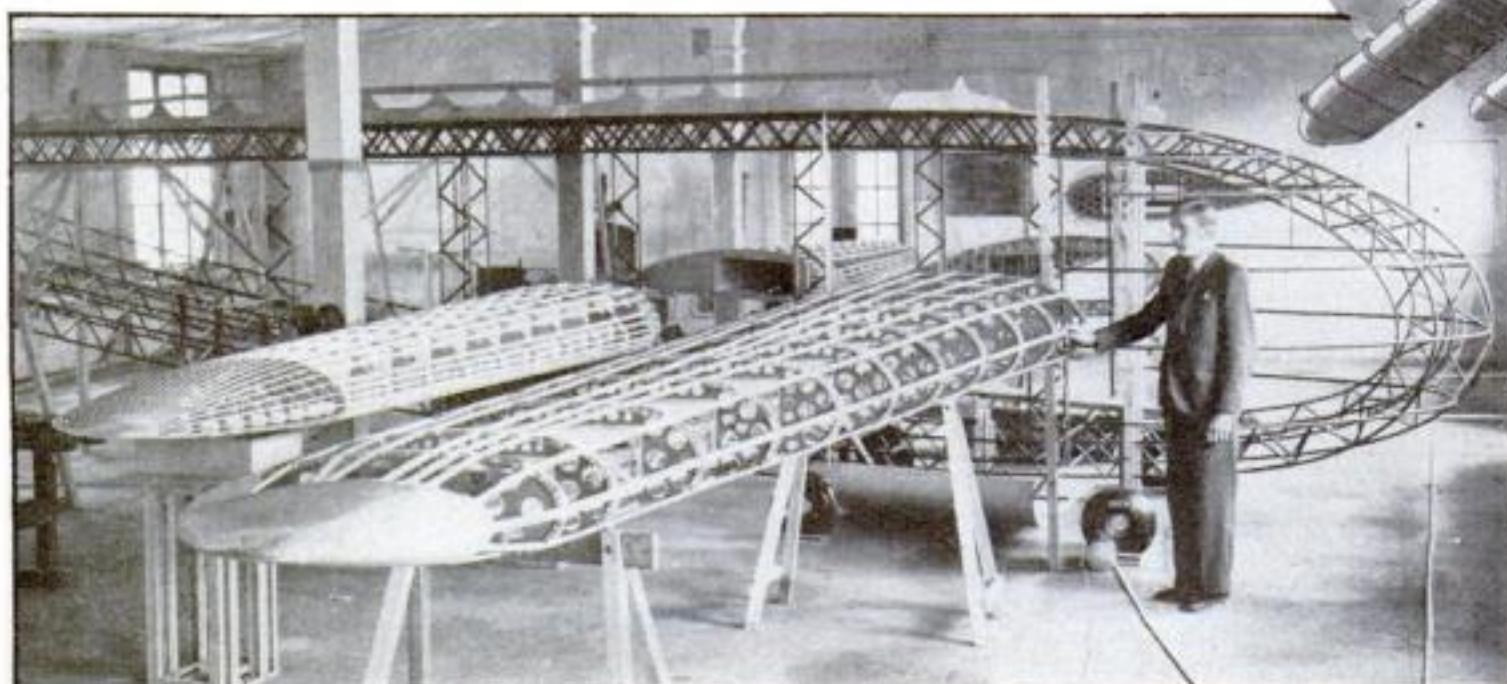
### DERRICK ON TRUCK CAN LIFT 1,500 POUNDS

MONTEED on the chassis of a two-ton motor truck, a traveling derrick, produced by a British firm, may be brought quickly to the exact spot where it is needed. One man controls the lifting apparatus, which is capable of raising from 200 to 1,500 pounds according to the distance of the load from the supporting framework. The unusual derrick is destined for use in a mining engineers' workshop, operating along driveways prepared for the purpose between rows of shop benches.

### NEW AIRPLANE TO RISE ON PULSATING WINGS

PULSATING wings instead of propellers are the means by which an Austrian engineer, Raymund Nimfuehr, seeks to drive a flying craft now under construction in his Vienna workshop. The under side of its wings is to be a mosaic of hundreds of pneumatic cells of

rubber, and their smooth outer surface may be given an undulating motion by pumping compressed air alternately into different rows. The inventor hopes to make his craft able to hover, dart forward, or descend vertically.



Left, building the Austrian plane that will have pulsating wings to help it descend vertically or hover in the air. Above, the new airplane as it would appear when actually being flown

# HOMEMADE FIRE ENGINE BUILT OF SCRAPS

BUILT of spare parts by members of the Wellesley, Mass., Fire Department, a forty-dollar fire engine is making regular runs in response to fire alarms. The midget engine can make forty miles an hour, carries a bell under one side of the driver's seat, has 300 feet of hose coiled in a special cabinet at the back, and can throw 268 gallons of water a minute on a fire. During the first week it was in commission, it answered more calls than the department's regular apparatus. It is said to be the smallest fire engine in actual use in the country.



## PERISCOPE GIVES DRIVER VIEW PAST OBSTRUCTION

SO DRIVERS can see ahead around trucks and slow-moving cars without pulling out of line, a periscope for autos has been invented by Jack Miner, of Madison, Wisc. Less than six inches long, the periscope is attached by a spring clamp to the top of the glass in the door beside the driver, as shown above. Miner worked out the idea after he had barely avoided a collision when he swung out from behind a truck.

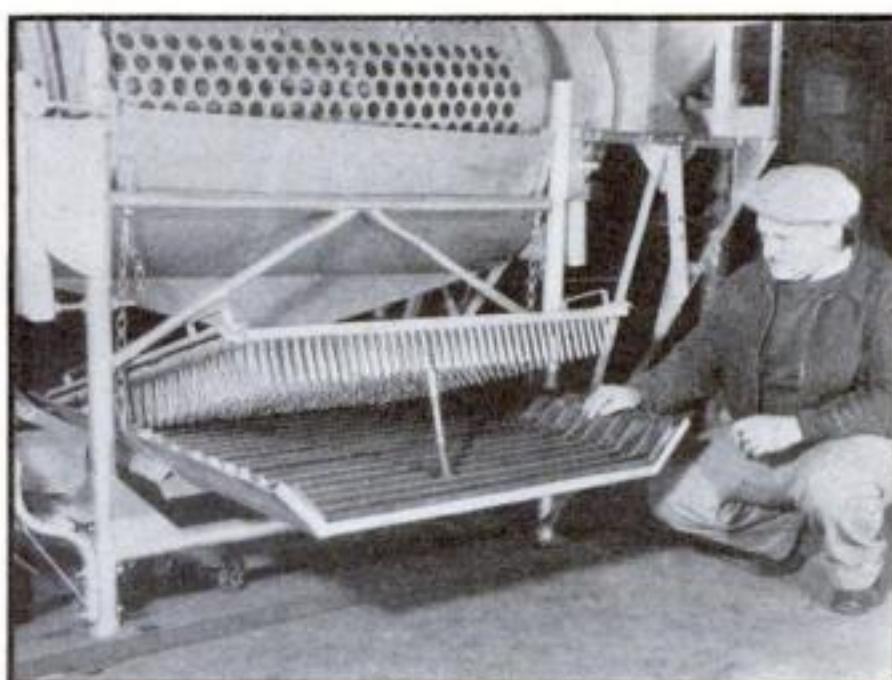
## BIGGEST THERMOMETER ADORNS EIFFEL TOWER

WHAT is called the world's largest thermometer now adorns the Eiffel Tower, famed Parisian landmark, replacing a huge illuminated clock that for some months occupied the same place. The new display, intended like its predecessor for advertising purposes, tells the temperature in luminous symbols that can be read from any point in the city that gives a view of the tower. The "mercury" is a vertical ribbon of light of variable height.

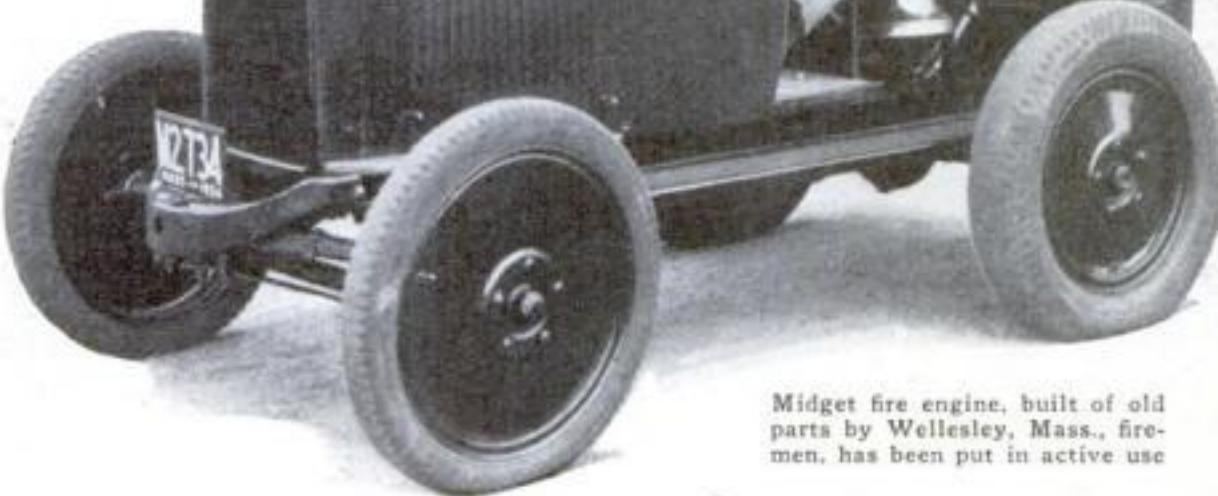


World's largest thermometer, with light for mercury, is now displayed on Eiffel Tower

## EXTRACT GOLD FROM "WORTHLESS" DIRT



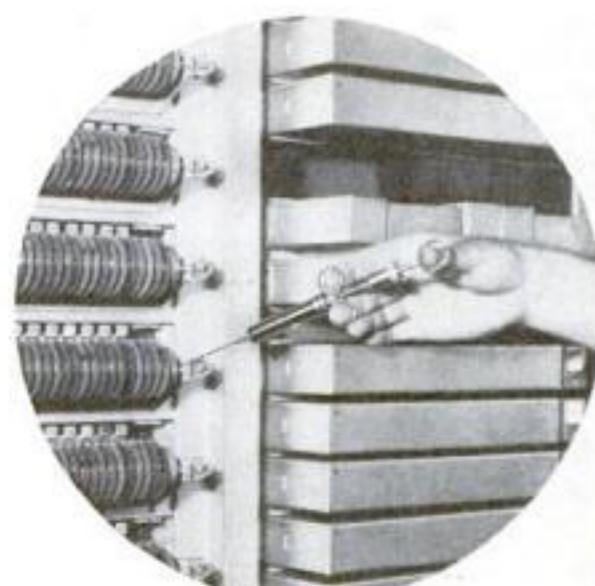
FREE gold, present in ground hitherto considered worthless, is now worked at a profit, it is said, by a machine recently patented. In using the machine the dirt is kept suspended in water by 1,700 metal rods in the moving riffle pan. This allows the heavier gold-bearing sand to settle. Any type of ground may be worked and ninety percent of the gold present can be recovered. In the illustration at left, the rods are raised showing the riffle pan.



Midget fire engine, built of old parts by Wellesley, Mass., firemen, has been put in active use

## OIL GUN SHAPED LIKE HYPODERMIC NEEDLE

FACED with the problem of feeding oil to hundreds of tiny bearings in dial telephone systems, engineers found a solution in a lubricating instrument shaped like a doctor's hypodermic needle. The oil gun, illustrated below, has a needlelike nozzle small enough to get into all tight places. It is used in a periodic inspection of the moving parts that automatically call the number dialed by a telephone user.



## ARTIFICIAL SPONGES NOW MADE OF VISCOSE

VISCOSE, versatile material already put to use in the forms of artificial silk, sizing, and cement, finds a new application as an absorbent sponge. The size illustrated can take up a half pint of water and is recommended for home use. In a photographic laboratory the sponge is declared useful for quick drying of film and other materials.

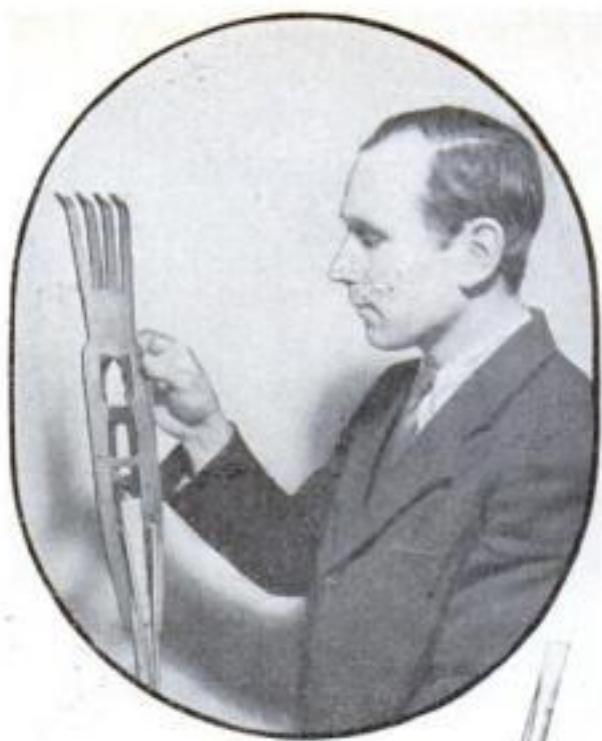


## AIR VENT MAKES SPEED BOAT FASTER



Air vent in step, pointed out above, is expected to increase boat's speed

BY PROVIDING an air vent running from the top of the gunwale, along the bottom of the step of a racing hydroplane, H. H. Raulerson of Long Beach, Calif., seeks to eliminate the drag caused by the partial vacuum formed under the step at high speed. A sixteen-foot experimental craft that he has built embodying his plan, shows one-third more speed, he declares, than a standard boat. The idea of providing an air vent of some type is not new, Raulerson points out, but he maintains that his plan of extending it clear across the extreme lower edge of the step gives unusual speed and pickup.



### FINGERS ON RAKE CAN BE ADJUSTED

WITH metal leaves that spread out or contract like the fingers of your hand, a "five-fingered" lawn rake is the production of a Connecticut inventor. The spread of the leaves, and consequently the width of the rake, can be adjusted from the handle during use, permitting the user to work conveniently amidst shrubbery and in close quarters. When the rake is put away, the leaves come together and overlap so a minimum of space is occupied by the tool.



### RAY METER MEASURES ULTRA-VIOLET LIGHT

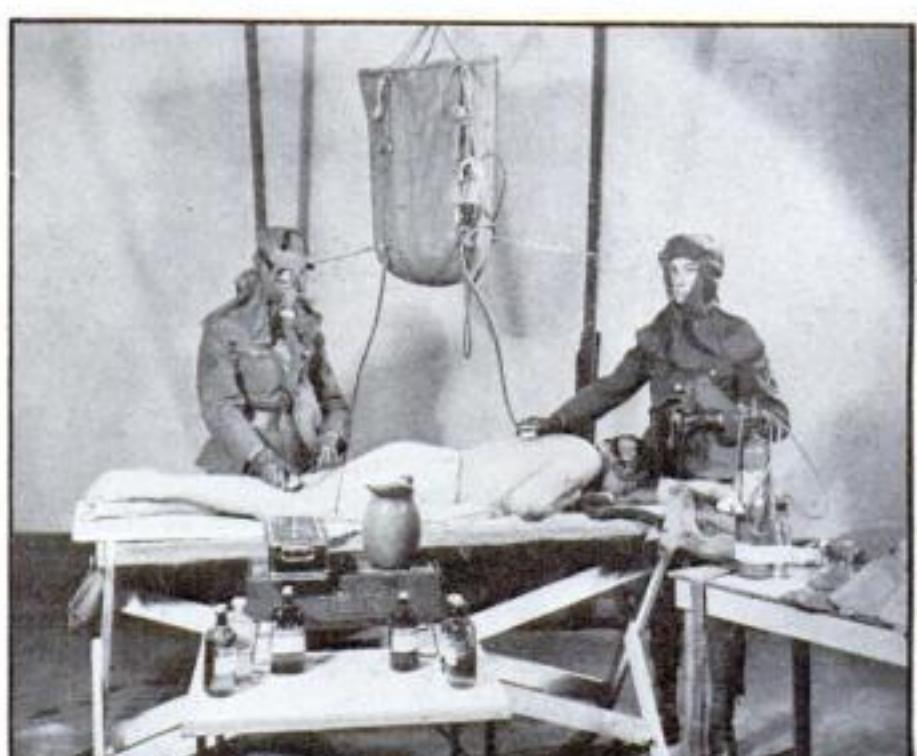
A RAY meter for measuring the amount of ultra-violet light coming to the earth from the sun or emitted by a lamp in any given unit of time has been perfected by Dr. Matthew Luckiesh and A. H. Taylor of the General Electric Lighting Research Laboratory at Cleveland, Ohio. It will be of use to physicians.



Pulley and chain easily open sticking freight-car door

### NEW TREATMENT FOR POISON-GAS BURNS

THE menace of Lewisite and mustard gas, which cause death by burning the skin instead of by asphyxiation, is said to have been largely overcome through a new treatment worked out by Capt. Francis A. Wells, a medical officer of the Nebraska National Guard. He has designed a gas-tight first-aid station which may be set up in a dugout or tent near the front. Gassed soldiers would be rushed into the station, stripped, and scrubbed with a special brush supplied with a continuous flow of bicarbonate of soda solution. This removes the gas. The medical officers would wear headpieces of rubber, which Capt. Wells has designed, as well as masks and rubber gloves to protect them from gas rising from the body of the patient.



This first-aid station was designed to treat poison-gas burns



### BIRD'S NEST ON ELECTRIC BULB

A HUMMING bird's nest warmed by electricity is reported from Los Angeles, Calif. The nest is above a light bulb.

# Thrilling Experiments You Can Perform with a HOMEMADE Spectroscope

By **GAYLORD JOHNSON**

UNTIL the year 1675, a triangular glass prism was merely a child's toy, an amusing way of casting a rainbow on the wall. After that date, this prism became the key that enabled scientists to unlock the most stupendous mysteries and secrets of the universe.

In 1675 interesting experiments were made with a prism and a ray of sunlight entering a darkened room. They were performed by Sir Isaac Newton and described by him in a little book called "Opticks."

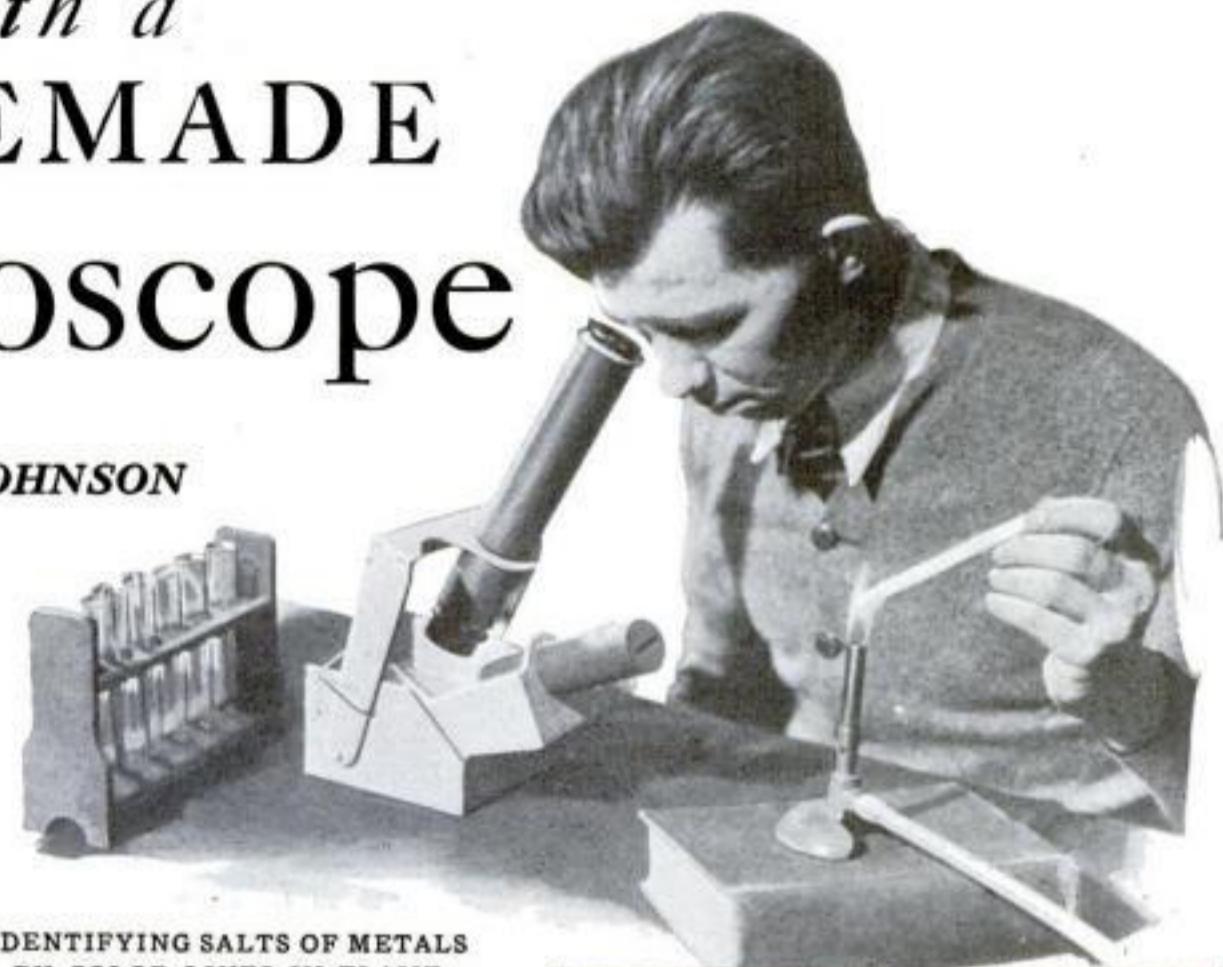
As one of the results of amusing himself with a prism in the sunshine, Newton concluded that "the whiteness of the sun's light is compounded of all the primary colors mixed in a due proportion."

At first sight this does not appear to be a world-shaking discovery, yet, in the course of time its effects have been stupendous.

The prism Newton turned in his fingers was only an inch or so thick, yet through what millions of miles and across what milleniums of time similar prisms were to bring knowledge of the universe to man!

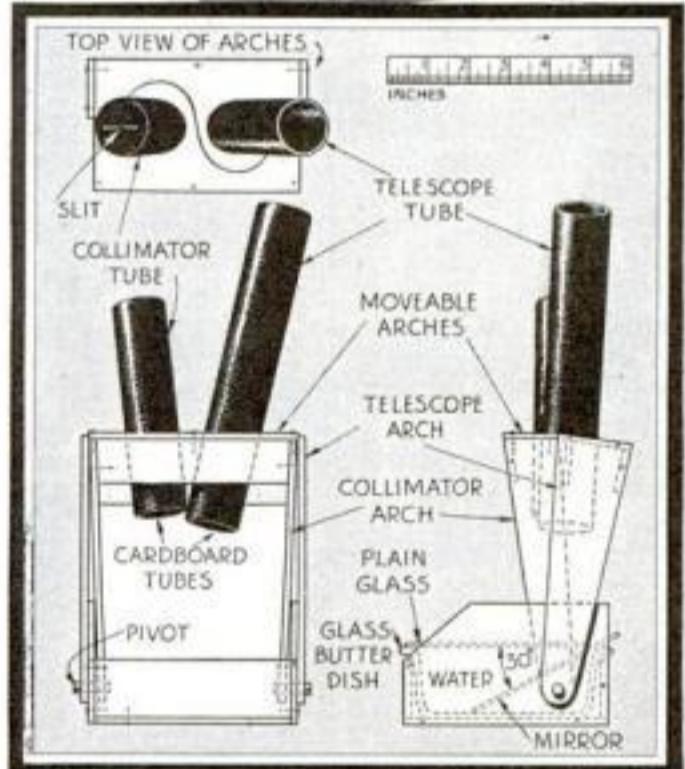
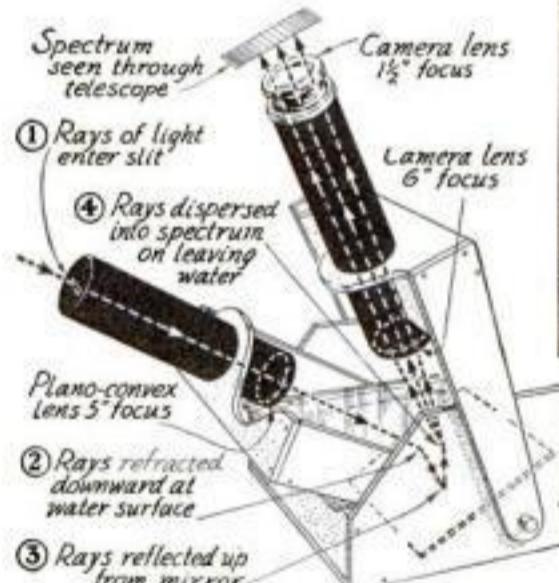
To mention only a little of the amazing information which the spectroscope prism has enabled scientists to obtain:

It has revealed unmistakably the intricate chemical composition of the sun and the other stars. It has measured the terrific speeds with which these enormous luminaries are traveling and determined whether their journeys are toward, or away from, our earth. It has indicated the probable size of the universe. It has estimated the age and destiny of the stars. It has ascertained the nature and density of Jupiter, Saturn, Uranus, and Neptune. It has given evidence for and against the pos-



## IDENTIFYING SALTS OF METALS BY COLOR LINES IN FLAME

With a water-prism spectroscope the observer looks at the spectrum of salts of metal placed on asbestos and held in the flame of a Bunsen burner. A bright line in the yellow indicates a salt of sodium and a red line identifies a lithium salt. In this way starlight is analyzed and the elements composing stars are identified. At right and below, plans show construction and operation of homemade spectroscope

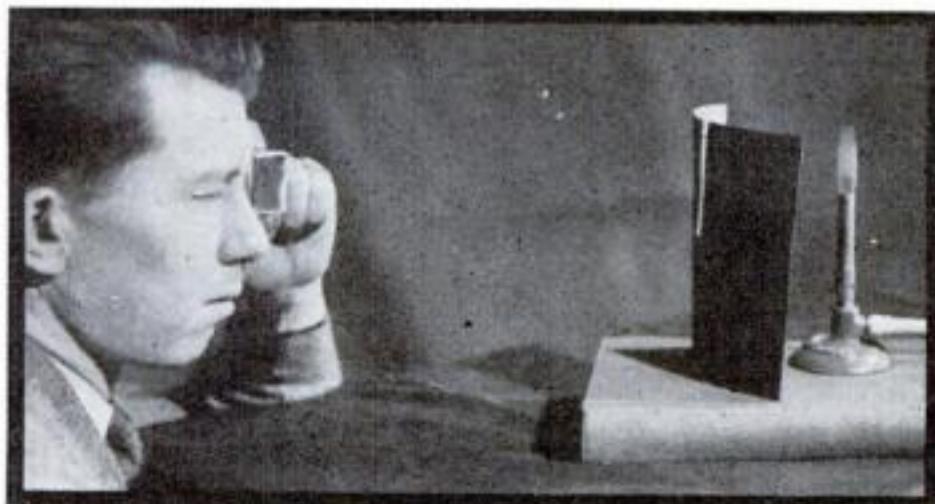


sible habitability of Mars and Venus. In a word, the spectroscope prism has brought within reach of man's mind a whole world of knowledge which, without it, he could never have possessed.

Yet, almost infinite in scope as the results of spectrum analysis are, the methods of building and using a spectroscope are so simple that they can be duplicated with materials within the reach of every one.

You need not even purchase a glass prism. With a few square inches of mirror, a shallow glass butterdish, a clean photographic plate, and a little water, you have at hand the essentials of a crude but effective spectroscope.

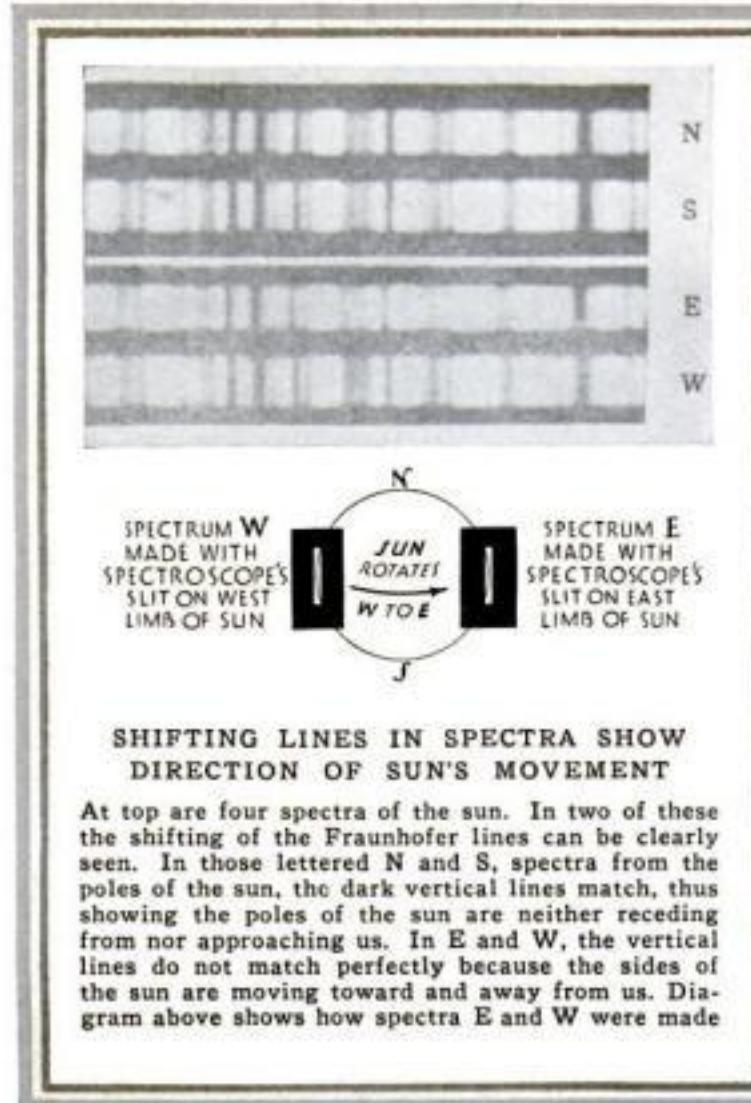
The illustration shows how these materials should be combined for best results. It also indicates how the two necessary refinements of spectroscope, the "collimator" and the "viewing telescope," are constructed. The collimator is simply a



## HOW TO USE GLASS PRISM

If you have a sixty-degree glass prism, spectrum analysis can be carried out as shown at left. A Bunsen burner is set behind a cardboard containing a slit and you sight at the flame through prism. The identifying color lines will be visible

# MYSTERIES of the Universe Are Opened to You with the Prism Which Interprets the Messages Received from the Sun and Remote Stars



## SHIFTING LINES IN SPECTRA SHOW DIRECTION OF SUN'S MOVEMENT

At top are four spectra of the sun. In two of these the shifting of the Fraunhofer lines can be clearly seen. In those lettered N and S, spectra from the poles of the sun, the dark vertical lines match, thus showing the poles of the sun are neither receding from nor approaching us. In E and W, the vertical lines do not match perfectly because the sides of the sun are moving toward and away from us. Diagram above shows how spectra E and W were made

### SPECTRUM SEEN ON CARDBOARD

Spectrum can be viewed without a telescope, as is illustrated at right. Sunlight is reflected from water prism through a narrow slit in collimator tube so it falls upon shaded white cardboard. Identifying lines will be visible if the slit is narrow



part of a camera lens mounted at one end of a tube of rolled black paper. The lens is plano-convex and achromatic. The other end of the tube is closed, except for a one-sixteenth-inch slit through which the sunlight is permitted to enter.

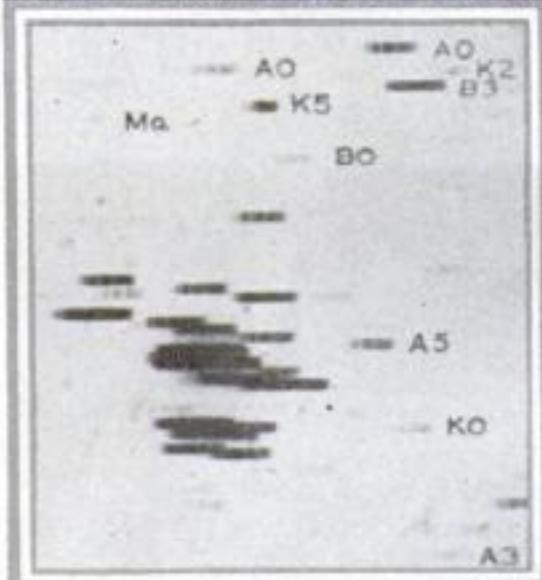
The length of the collimator tube is equal to the focal length of the lens. In other words, the slit is at the focus of the lens. The effect of this arrangement is that the rays of light which enter the slit are gathered into a beam of parallel rays as they pass through and leave the lens.

The top face of our spectroscope's water prism is formed by the clear glass plate. The prism is bounded below by the slanting mirror. The parallel light entering the top face from the collimator is refracted downward by the water; is reflected back by the mirror; and is dispersed into a spectrum as it leaves the top face of the prism.

This spectrum can then be caught on a strip of white cardboard, or examined by a short telescope.

The telescope is merely another black paper tube, with a medium-size camera lens in the lower end as an object glass and a small short-focus camera lens in the upper end as an eyepiece. This telescope is really just a magnifier, making the image of the spectrum appear several times larger. Almost any achromatic camera lenses can be used. The only essential is that they shall be placed the proper distance apart in their tube to bring a distant tree or house into sharp focus when the telescope is trained on it. When this condition is met, the tube and the collimator can be mounted in their movable cardboard arches.

To get the two tubes set at the correct angles so that the spectrum sent out by the upper face of the water prism is visible through the telescope is easy, but re-



**SPECTRA OF STAR GROUPS.** When the spectra of a group of stars is photographed upon one plate, as above, through an eyepiece prism, the different types of spectra are used to classify the star's stages of development, as young, mature, or very old

quires a little experimenting. When the proper positions are found, the tubes should be fastened in place by cardboard supports.

The two arches are pivoted at a point level with the center of the water prism. The collimator can then be made to point toward the sun at any height, and the telescope can be moved until the spectrum is seen through it.

After your spectroscope is built, you are ready to undertake a simple bit of

### HOW SUNSPOTS MAY BE EASILY VIEWED

By attaching a white card to an adjustable framework, as at left, an image of the sun can be projected on the card. In this way sunspots present become visible in the sun's image

spectrum analysis. First, however, you must become familiar with those strange markings, seemingly ruled with black ink across the spectrum of the sun, which are called the "Fraunhofer lines."

To see the Fraunhofer lines, place your water prism spectroscope in a sunny window so that the sunshine enters the slit of the collimator. It is a good plan to shield the rest of the apparatus by passing the collimator tube through a sheet of black paper.

The sunlight that passes through the collimator slit enters the water prism, is reflected upward by the mirror, and dispersed into a band of color as it leaves the water prism.

If you catch this band upon a white card and examine the colors closely, you will see them crossed by a number of the fine, dark Fraunhofer lines. You will see a prominent dark line in the yellow color, and others in the green, red, and violet. Several of these, Fraunhofer, their discoverer, designated by the letters of the alphabet. The dark line in the yellow part of the spectrum he called by the letter D.

Now the remarkable thing about this dark D line is that it occupies the exact spot in the sun's spectrum band which corresponds to a very bright yellow line in the spectrum of a burning salt of sodium.

You can demonstrate this with your homemade water prism spectroscope. It will be your first spectrum analysis.

To try the experiment you will need only a solution of common salt, a strip of asbestos card or paper, and a Bunsen burner. A platinum wire loop will do in place of the asbestos, if you have it.

Adjust the collimator and telescope so that you can see the spectrum of the blue flame. Then dip (*Continued on page 103*)

# Uncle Sam's New Treasure House for

# GOLD

WILL HOLD LARGEST QUANTITY  
EVER GATHERED IN ONE PLACE

WHEN, on January 31 of this year, through the enactment into law of the new Gold Reserve Act, the government took over the ownership of all the monetary gold in the United States, it placed on the Treasury Department the tremendous responsibility of safeguarding the richest hoard of the precious yellow metal that the world ever has known.

Not even the officials of the Treasury know exactly how much monetary gold there is in the United States. Under the old Gold Standard, which demanded that gold coins contain 23.22 grains of fine gold to the dollar, our known monetary gold was valued at something over four billion dollars, and Treasury officials estimated that another half billion's worth was in existence. The new Gold Reserve Act, by reducing the gold content of the theoretical gold dollar to 13.93 grains, increased the dollar value of our stock of gold to something like seven billions. Eventually, it is probable, almost

Gold is so essential in international commerce that its swift transportation is often necessary. Below, plane landing French gold at Croydon Field, England

By  
*Arthur Grahame*



Above, one of the old-time adventurers who followed the golden lure and washed gold out of the sands of mountain streams. The depression brought back these placer miners. Left, how the world's gold supply is distributed among its nations here and abroad

all of this wealth will be concentrated in the new vaults of the Treasury on which workmen are busy putting the finishing touches.

Worthy of the world's richest treasure is this world's greatest treasure house.

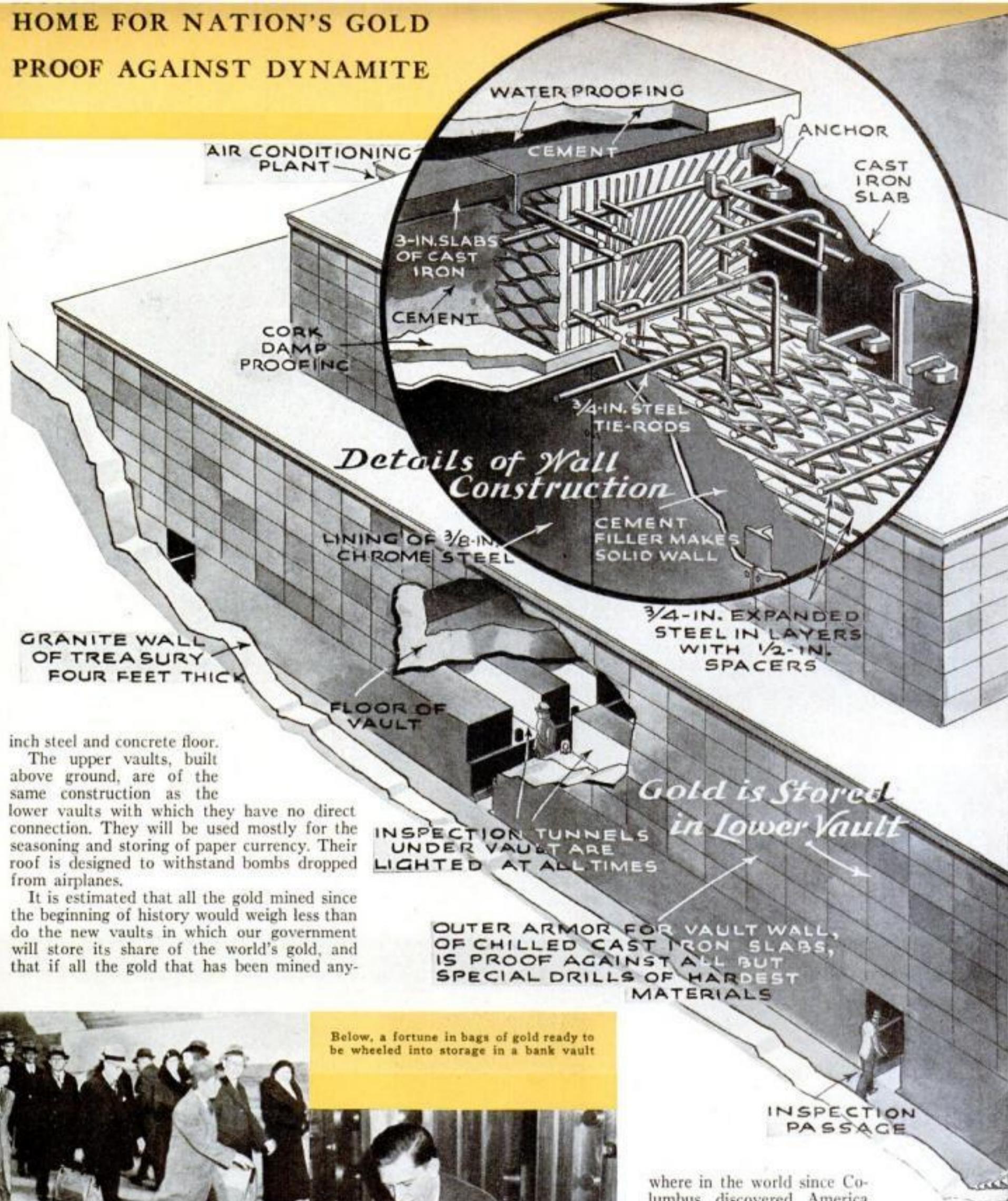
Built, at a cost of \$400,000, of 20,000 tons of steel and concrete in a courtyard enclosed by the four-foot granite walls of the Treasury Building in Washington, the new vaults are so obviously impregnable that no sane cracksmen ever will attack them.

Their walls, floor, and roof have a smooth outer facing of three-inch steel so hard that no drill has been able to even scratch it. Back of that facing is a twenty-seven-inch-thick entanglement of enlaced steel rods embedded in concrete, against which even the most powerful explosives would have little or no effect.

Most of the nation's gold eventually will be stored in the underground vaults. The one entrance to them is a passage guarded by a forty-ton steel door fitted with time locks and signal contacts wired to the office of the captain of the guard. In each compartment of the vaults there is a microphone, also wired to the guard office. Under the vaults, running through their concrete foundation, are numerous tunnels. Guards, making their rounds through dark passages, are able to flood these tunnels with light and, themselves invisible, have at their mercy anyone attempting the impossible exploit of burrowing upward through the vault's thirty-



# HOME FOR NATION'S GOLD PROOF AGAINST DYNAMITE



When the call for hoarded gold was made, American citizens hurried to the banks carrying the treasured coins in hand bags, as above. In this way millions of dollars were returned to the government.

Below, a fortune in bags of gold ready to be wheeled into storage in a bank vault

where in the world since Columbus discovered America were cast into a single cube, the sides of that cube would measure less than forty feet!

No one knows, as yet, in just what form we eventually will keep our golden treasure. So long as the present Gold Reserve Act, which permits the President to vary the gold content of the dollar between 11.61 and 13.93 grains, remains in force, there will be no more coining of "eagles" and "double eagles," or of other gold tokens. The newly mined gold that the government now is buying for \$35 an ounce is being cast into bars. Eventually all of our present gold coin may be melted down and recast in the same form. But, whether it be in bars or coin, it will be guarded safely in

In the vaults shown in this illustration, America's enormous supply of gold will be stored. Steel plates and walls of concrete and steel make the vaults burglar-proof, as the cut-away sections in this drawing clearly show. In the upper vaults, also burglarproof, paper currency will be placed for seasoning and also for storage

ELECTRIC ALARM SYSTEM  
INCLUDES TWO MICROPHONES  
IN EACH COMPARTMENT  
TO PICK UP ALL SOUNDS

40-TON DOOR WITH  
TIME LOCK

*Upper Vault  
is Used for Currency*

4-FT. GRANITE  
WALL OF TREASURY  
BUILDING

CEMENT

IRON SLABS

TIME LOCK  
CONTROLS  
40-TON  
VAULT DOOR

COIN  
LIFT

STAIRWAY  
TO MAIN  
FLOOR

SILVER  
VAULT

COIN  
TRUCK  
LOBBY

ALL GUARDS  
CARRY  
REVOLVERS  
AND TEAR  
GAS PISTOLS

ALL GATES,  
MADE OF 3-IN.  
STEEL BARS, HAVE  
DOUBLE LOCKS WITH  
TWO KEYS

the new Treasury Vaults and held there as a guarantee of the worth and soundness of our paper currency and government bonds.

At present much of our gold is in the vaults of the United States mints in San Francisco, Denver, and Philadelphia, and of the Federal assay offices in New York, Seattle, and New Orleans. When the new vaults are completed, it will be concen-

trated in the Washington treasure house.

It happens that our present stock of monetary gold is just about equal to the amount of gold produced in the United States between 1792 and the end of 1932—226,326,025 ounces, or

about one-fifth of all the gold that has been mined throughout the world since the discovery of America.

In 1932 the miners of the world established an all-time record by producing over 24,000,000 ounces of gold. Almost half of it came from South Africa. Canada's production was over 3,000,000 ounces. We mined over 2,500,000 ounces. Russia, again working the rich Siberian deposits that once made her the world's leader, ranked fourth with over 1,500,000 ounces.

## HOW NEW GOLD IS PRODUCED AND OLD GOLD IS CONSERVED



Upper left, a dealer in old gold is appraising a piece of jewelry. Note the large assortment of ornaments he has assembled, for gold is always gold. Above, old gold is melted down and poured into molds without losing any value

From 1850 to 1900, the United States led the world in gold production. The Transvaal gold fields came under British control in 1901, and in the years since 1905 South Africa has produced anywhere from twice to four times as much gold as we have. We reached our high water mark in 1915, when we mined close to 5,000,000 ounces.

Some of the gold in our vaults has come to us from the present great mining districts of the world. But much more of it has come to us out of the past. Gold's easy malleability and weldability makes it easy to change its shape without lowering its value. The gold in a ten-dollar piece may have been part of the loot taken from an Inca temple by the Spaniards. The gold in the ring on your wife's finger may once have clinked in the pocket of some swaggering pirate or played its part in Oriental wars.

Probably the bulk of our stock of monetary gold is a heritage from the series of great gold rushes that for a half century were a colorful and economically important feature of American life. Some of it rewarded the red-shirted adventurers who crossed the plains to California in 1849. Some of it was blasted from the Comstock Lode in the Sierra Nevadas, and may have been tossed across the bars and gambling tables of Virginia City, for several decades the world's most-famous mining camp. A little of it may have been panned by the "pilgrims" who painted "Pike's Peak or Bust" on their covered wagons as they stampeded hopefully for the Colorado wilderness in 1859. More of it probably was won from the frozen earth of the North by the rushers who in 1898 braved the terrors of the Chilkoot Pass and two thousand miles of wilderness to get into the Klondike. Some of it may have been mined by these same men when, a couple of years later, they were sweating on the Nevada desert in the Goldfield and Tonopah fields.

It seems probable that the days of great

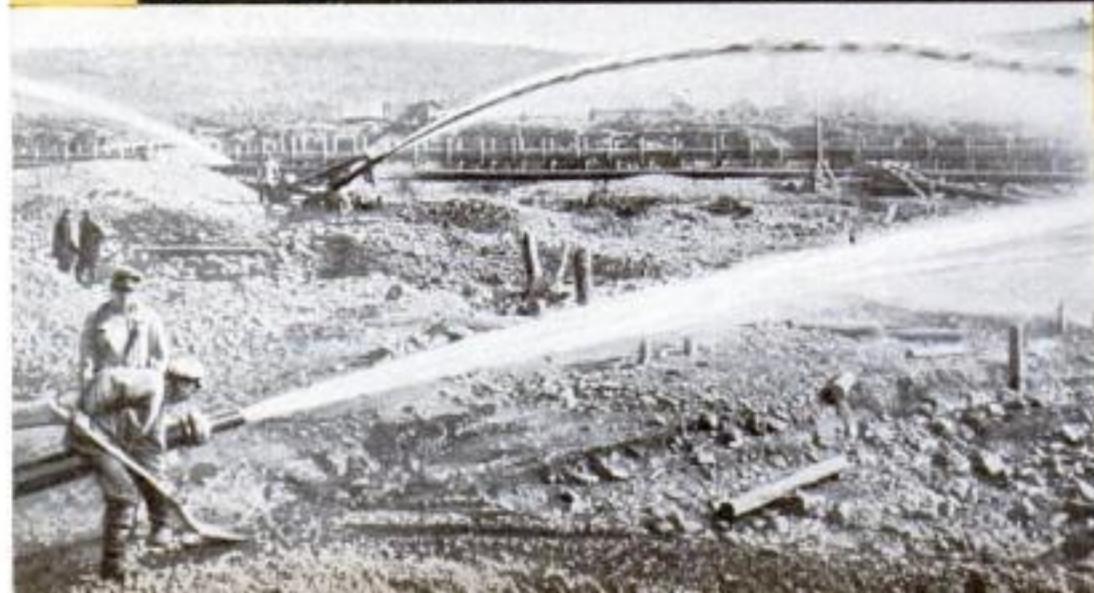
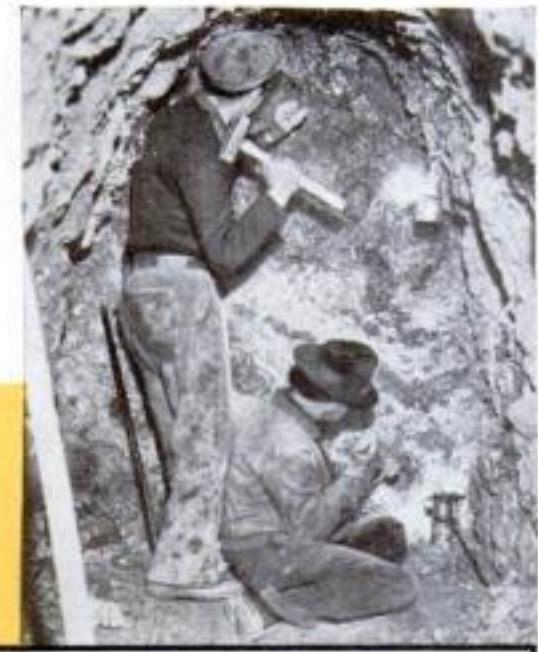
comes up 4,000-foot shafts of the Witwatersrand mining district of the Transvaal. Almost nine tenths of Canada's gold comes from the lode mines of Ontario. Three quarters of our gold comes from the lode mines of our Western States and Alaska, and a good part of the remaining quarter from the dredges of Alaska and California.

Gold mining, like most other industries, has changed. Lode, or underground, mining distinctly is not a poor man's game. It demands machinery and working capital. Shafts must be sunk, and galleries run along the veins in which it is hoped to find gold. The ore-bearing quartz must be hoisted to the surface, pulverized in a stamp mill, and washed to recover the gold. *(Continued on page 115)*

gold rushes are past. They were caused by the discovery of rich deposits of easily worked placer gold. The hard-fisted adventurers who followed the gold lure didn't need to worry about capital or machinery. In those days a man knew that a grub stake, a pick, a shovel, a gold pan, a strong back, and something more than his share of luck were all that he needed to win wealth from the earth.

Now the placer deposits are nearly worked out. Not ten per cent of the world's gold comes from them. South Africa's rich yield

Right, modern gold mining at the bottom of a deep shaft, similar to those now worked in South Africa. Below, dredging for gold with buckets that carry gravel to hoppers on the dredge. Bottom, hydraulic mining in Russia



• LITTLE EXPERIMENTS SHOW

# Why Nature Makes Things SIX-SIDED

**W**HY does the bee make the cells of its comb hexagonal? Why are the living cells of many plant and animal tissues also six-sided?

In the case of the bee's cell, mathematicians say that its six-sided shape provides the maximum space with the minimum amount of wax. Many scientists have praised the bee for recognizing the efficiency of this pattern for its cells.

Recent experiments have proved that a single mechanical principle is responsible, not only for the bee's six-sided cell, but also for many other hexagonal structures in plants and animals. These experiments, interesting to perform, require no elaborate apparatus. The only materials needed are a lump of modeling clay, a flat-bottomed plate, a little salt, carmine water-color paint, and a medicine dropper.

To demonstrate the mechanical law responsible for the bee's six-sided cell, cut from the clay seven strips about one half inch wide and thick by two inches long. Roll each strip upon a flat surface until it is an even cylinder, like a thick pencil or piece of chalk.

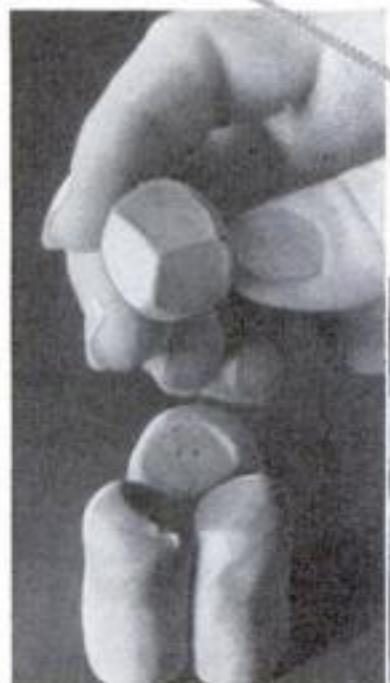
Then cut these seven rods to an even length and stand them on end, with one in the center and the other six around it.

When this bundle is rolled between the hands with considerable force, the curving sides of all the cylinders in contact are flattened into plane surfaces. As a result the central cylinder is converted into a hexagon.

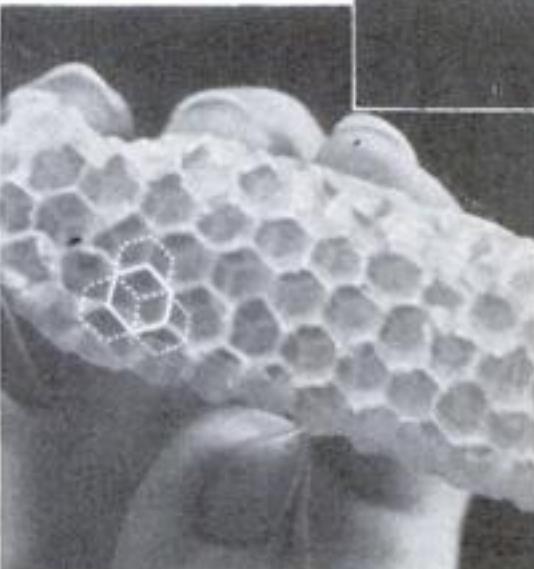
This experiment makes it plain that the bee can build only six-sided cells, for, even if its cells were all built round, the weight of the surrounding honey would gradually force them into hexagonal form.

Even more remarkable is the experiment which shows how efficiently the two tiers of cells are fitted together at their bases.

In one illustration, dotted lines indicate how each cell is in contact, at its base, with the bases of three



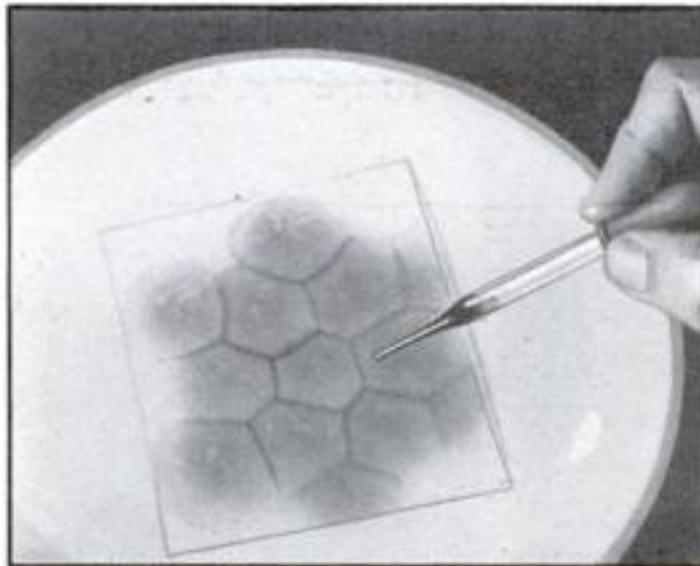
Three identical cylinders of clay are stood together as shown. A fourth is pressed down upon them. When lifted off, its end is three-sided



Above, cylinders of clay squeezed together give the center cylinder six sides. Left, dotted lines show diamond-shaped facets formed at the base of bee cells

other cells on the opposite side of the honey comb. The floor of each cell is formed by three diamond-shaped facets set at an angle with each other. To demonstrate how these facets are formed in response to a mechanical law is easy and fascinating.

Prepare four identical cylinders of clay. Round one end of each into a hemisphere. Then place three of them in contact, crowding them together until the adjacent sides are flat planes. Finally, force the fourth cylinder's hemisphere down upon the curved tops of the other three cylinders, exactly over their junction at the center squeezing it firmly in place.



When drops of a colored salt solution are placed on a flat plate, above, in a weaker salt solution and then allowed to expand, six-sided "artificial tissue" results

When you lift off the fourth cylinder you will find that its end has been shaped into three diamond-shaped facets, exactly as is the base of the bee's cell.

If you have ever looked at an animal or plant membrane under a microscope, you have noticed how the flat cells form a pattern of hexagons. That even these living cells obey the law of pressure which forms the bee's cell into a hexagon is easy to prove.

You will need two salt solutions of varying strength. Prepare them in two half-pint cream bottles. Into one bottle place two teaspoonsfuls of common salt; into the other put eight teaspoonsfuls. Then fill each with water and stir until dissolved.

Pour into a flat-bottomed plate enough of the weaker salt solution to cover the bottom. Now put a little of the stronger salt solution in a teacup. With a camel's-hair brush mix in it carmine water color until the color is bright red. Now you are ready to start your experiment.

To do this, fill a medicine dropper with the red salt solution and carefully let a drop fall into the center of the plate. Then quickly let fall six additional drops so that they surround the first. Try to place each about an inch away from the central drop. Finally, put in six more drops so that they surround the first six.

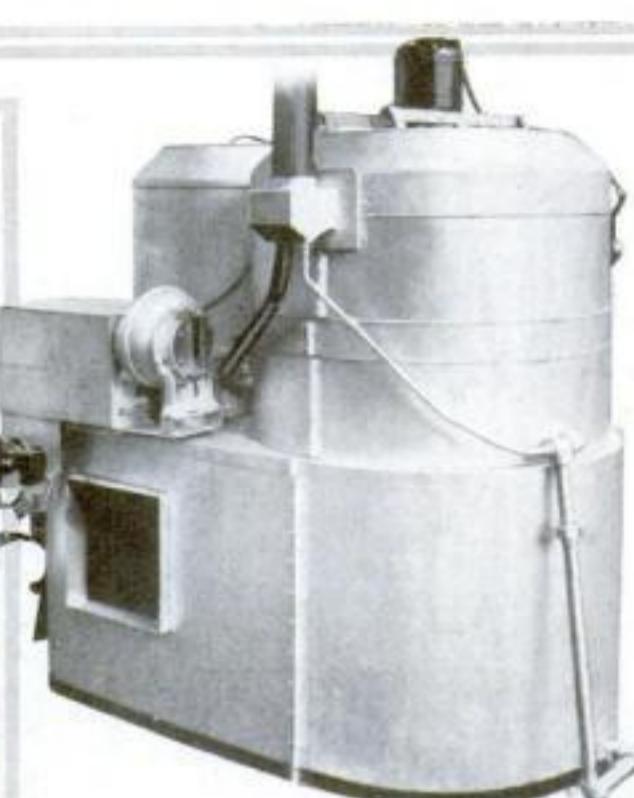
Now watch the drops of the stronger, colored solution diffuse into the clear, weaker one. At first each drop will expand as a perfect red circle, but as the circles begin to meet, their opposing pressures will flatten out the lines of junction.

That the straight boundary lines are due to the opposing pressures is proved when we notice that the edges of the expanding drops remain circular at the outer edge.

# New Devices



HOME HEATER WORKS LIKE BLAST FURNACE. Low-grade coal, pulverized and compressed in the form of sticks, is used as fuel in a new home heater that works on the principle of a blast furnace. An automatic magazine, shown at upper left being filled, feeds fuel to the fire. One filling lasts a day, it is claimed. Upper right, a rear view of the heater



NEW FOOD MASHER. Simply by turning a crank, food put in a new device is quickly mashed. It can be used, also, to rice all kinds of vegetables or for smashing fruit

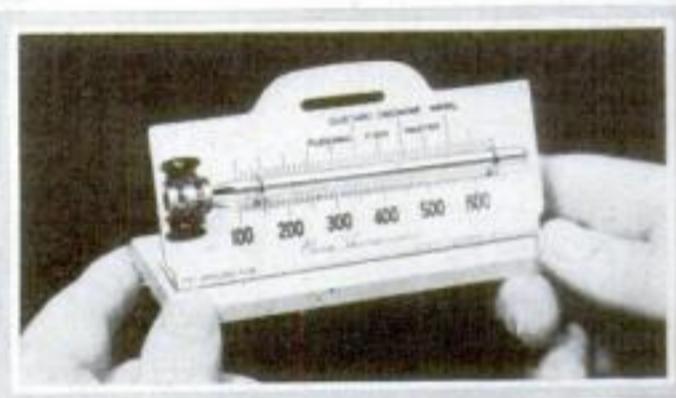


ONE-HANDED HANGER. A garment can be placed on the hanger shown above with one hand. In this way it is easy to avoid soiling or damaging the dress. The hanger folds downward and then snaps back to original position. An extra wire piece prevents the hanger from folding down accidentally

SHOVEL FOR HOT DISHES. To remove dishes from stove or oven, this shovel is slipped beneath them and they are lifted by means of the handle, which always remains cool

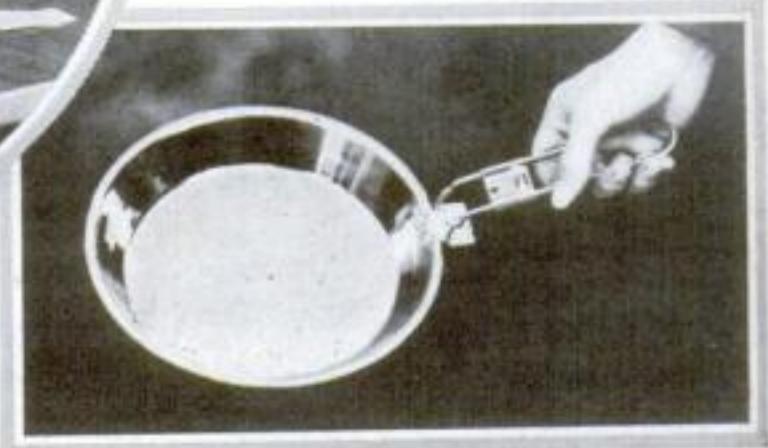


GLASSES CAN'T TIP OVER. Sunken metal cups in the corners of this bridge table hold glasses and prevent them from sliding off or tipping over. The table is the correct height for card playing and is solid and well built



OVEN THERMOMETER. Placed in the oven in a horizontal position, this thermometer does not tip over but rests firmly upon its solid asbestos base. Its manufacturer says its reading is very accurate

PIE PLATE AND FRYING PAN. To turn the pie plate, seen below, into a frying pan it is necessary merely to attach the handle. The pan, of regulation depth, thus gives the housewife two useful kitchen utensils combined in one



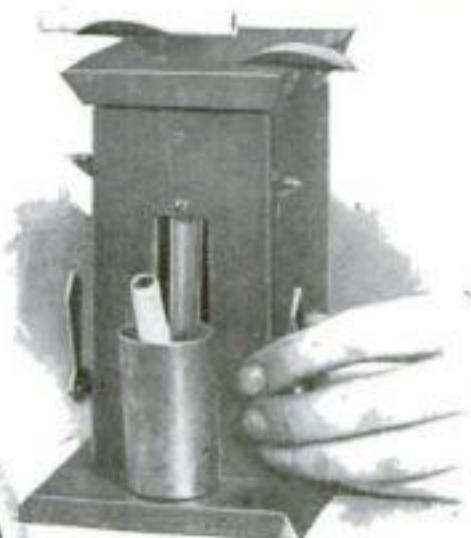
# for the Household



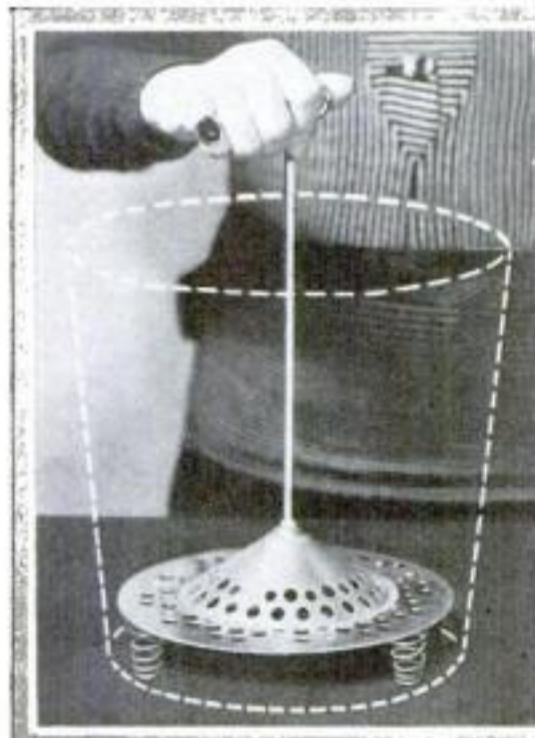
**THREE PANS IN ONE.** A skillet that fits on one gas burner will cook three pancakes at once without piling them on top of one another. It also can be used to cook three different things without mixing them



**NEW BED CHAIR.** An invalid is held in a comfortable sitting position with the portable cushion seen in use below. It has only sides and arms but is firmly stuffed and holds its shape a long time



**SMOKER'S OUTFIT.** Two different kinds of cigarettes are dispensed by the container, shown above, when a small lever is turned. The cigarette is forced against a lighting element and so comes ready to smoke. The device also contains a large tray for ashes



**MILK-CAN HOLDER.** When a milk can is placed in the removable base of this device, as seen in small picture, two concealed punches make holes in the top as cover is forced down. It is also a pitcher

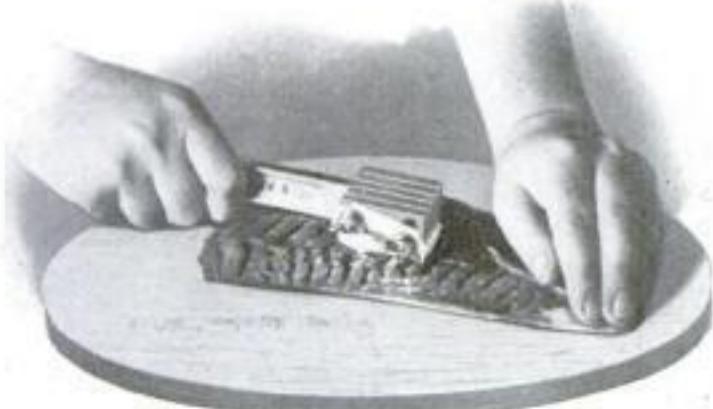


**VERSATILE DUTCH OVEN.** Chicken can be fried and eggs poached at the same time in the dutch oven above. The inner section is a salad bowl

**LINGERIE WASHER.** Dainty garments are easily washed in this little hand washer which forces water through them and carries away all trace of the dirt. Suds are forced up through clothes as handle descends

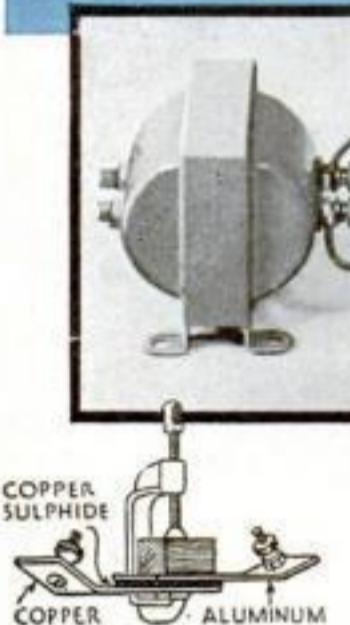


**MAKES YOUR STEAK TENDER.** Old razor blades are used in the device shown below. Held between spacer blocks, and secured with removable bolts, they are drawn across a steak and cut it into small cubes



**INTERCOMMUNICATING SYSTEM FOR HOME**  
With microphones and loud speakers installed, the system illustrated here permits two-way conversation between the rooms of a home. The master station is shown at left and above, a microphone in the nursery permits mother to keep in touch with the unseen baby

# Active Nature of COPPER



With a dry rectifier, constructed as shown in the drawing at left and arranged for use in the manner illustrated above, an alternating current can be converted into a direct current. The copper sulphide couple allows the current to travel in one direction only

**N**O LIST of home chemistry experiments would be complete without mention of copper and its many compounds. It is one of the oldest and most used metals and plays an important part in modern industry.

Although soft and pliable, copper is an extremely durable metal. If your house is fitted with copper leaders and eavestroughs, examine them carefully. If they have been standing any time, you will notice a greenish coating or discoloration. Remove some of the coating by scratching it with the point of a knife and you will find the deep, reddish color of copper.

It is this green coating that protects the copper. Caused by the moisture and carbon dioxide in the air, it is a rust that forms readily on any copper surface that is exposed. However, once it has formed, it protects the metal from any further action of the air and because of this protective covering, copper ornaments left exposed for centuries still are intact and little changed.

Chemically, copper is a particularly active element. It combines with many substances to form valuable compounds. The formation of copper sulphide, one compound of this type, was described in a recent issue (P. S. M., Apr. '34, p. 56). In this experiment, copper and sulphur were made to combine dry by thrusting red hot copper into molten sulphur. The same chemical can be prepared, however, by the wet method, by allowing hydrogen sulphide gas to pass into a solution of copper sulphate or copper nitrate. The copper sulphide precipitated then is decanted several times with water and filtered off. The resulting chemical, a greenish black powder, can be dried on paper napkins and stored in a tightly stoppered bottle. If left exposed to the air, it will combine with the oxygen to form copper sulphate.

Copper sulphide produced in the home laboratory can be used to make a useful and interesting dry rectifier that will convert alternating into direct current.

First, select a suitable strip of copper and another of aluminum. Between the

Arrange your apparatus as shown in photo at the right. As copper chemical is placed in the flame, the color is changed to greenish-blue. When the copper chloride is decomposed, the neon lamp will glow, proving the flame will conduct electricity



## Simple Experiments Enable You to Reduce Various Forms of Man's Oldest Metal to a Metallic State. How Alternating Can Be Changed to Direct Current

two place a thin layer of the dry copper sulphide, arranging the chemical so that the two strips are entirely isolated from each other. Finally clamp the strips together with a small C-clamp, using a block of wood as an insulator between the upper jaw of the clamp and the top strip.

To test your rectifier, connect it to the output of a small bell-ringing or toy transformer as shown. Then prepare a piece of polarity test paper by soaking white paper in some phenolphthalein solution to which a small amount of ordinary salt, potassium chloride, or potassium sulphate has been added. Place the two free ends of the wire (one from the transformer and the other from the rectifier) on the paper and switch on the current. The copper sulphide couple, although supplied with alternating current from the transformer, will allow the current to flow only in one direction. This will be shown by the fact that the paper around one wire will turn red. If the current is alternating, the test paper will turn red over the wires.

**T**HE home chemist can experiment with similar rectifiers made with strips of other metals separated by other chemicals. Dry rectifiers of this type often rely on various combinations.

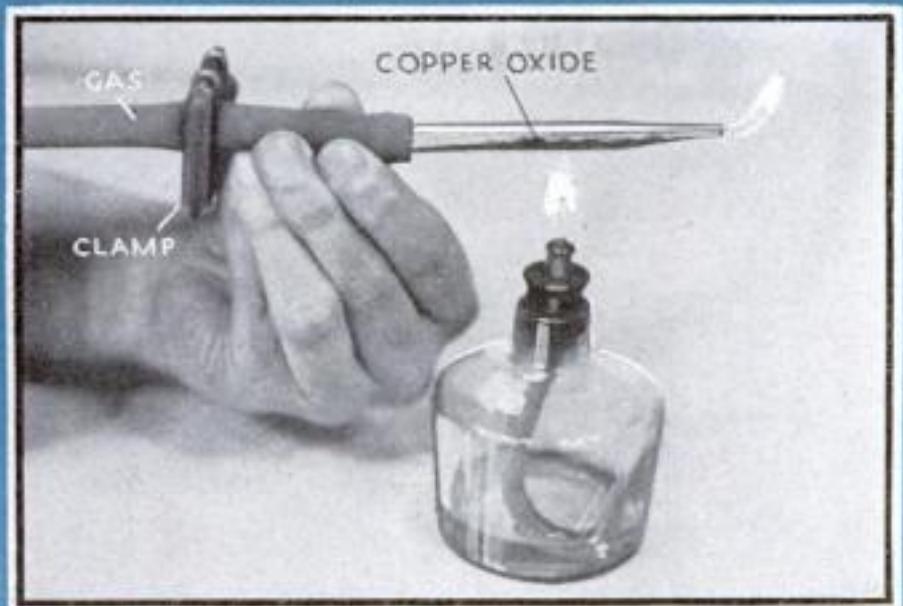
Most common of all copper chemicals is

copper sulphate, or bluestone, as it is sometimes called. One of its best known home-chemistry uses is to copperplate an iron object. This same experiment can be performed with other metals. A piece of zinc thrust into dissolved copper sulphate, for instance, will cause the solution to become warm and free the copper. If enough zinc is used, all of the copper contained in the solution can be precipitated out by the reaction. The metallic copper, present as a powder, then can be filtered off and the remaining solution used to produce white crystals of zinc sulphate by evaporating it over a water bath.

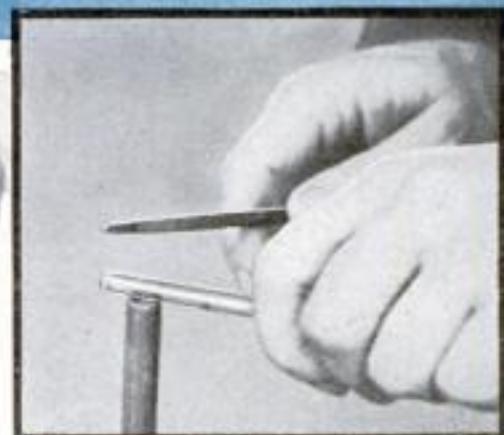
**T**O MAKE sure that the reaction has been completed and that none of the copper remains, add some ammonium hydroxide to the solution. At first, a precipitate will be formed but it will disappear or dissolve as more of the ammonium hydroxide is added. If the final solution appears blue, copper is still present as an impurity and indicates that the zinc was not left in contact with the copper sulphate long enough.

Incidentally, this same ammonium hydroxide test can be used to detect the presence of copper in any solution. The one requirement of the test is that the ammonia water be added in excess.

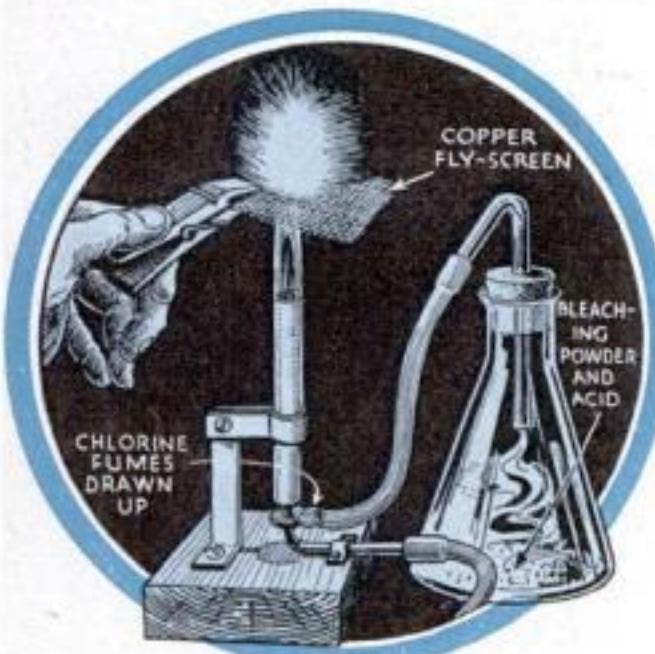
# Proved in Your Laboratory



Copper oxide can be changed to metallic copper with the apparatus shown above. As the oxide is heated by the alcohol lamp, the change takes place



To break off a short piece from a glass tube, file a mark around the tube and then, holding it as shown above, tap the tube lightly with the file. A clean break will result and there is little chance that you will cut your fingers



Chlorine gas from the flask at right passes into the air port of the Bunsen burner. Metallic copper held in the flame will at once turn it blue

Perhaps at some time or other you have noticed that your supply of copper sulphate crystals becomes coated mysteriously with a soft white crust? This is due to the fact that the crystals readily lose their water of crystallization. If heated gently, fresh crystals of copper sulphate will turn white as they give up all of their water of crystallization. However, when water, or a liquid containing water, is added to these white crystals, the characteristic blue color will reappear, offering an excellent test for the presence of water in alcohol or other liquids.

Simplest of all copper compounds to prepare is copper oxide—a combination of copper and oxygen. Simply heating copper nitrate, copper hydroxide, or copper carbonate will produce it. If you have none of these chemicals on your laboratory shelf, you can make them also for your experimental work.

Copper hydroxide can be prepared by adding ammonium hydroxide to copper sulphate solution. Do not add too much ammonium hydroxide as the precipitate of

The illustration above shows a simple manner of producing metallic copper from copper oxide. A copper wire coil is heated in the outer flame of a gas burner until it becomes coated white with copper oxide. While still hot, plunge it in alcohol. The oxygen is extracted leaving copper

By  
RAYMOND B.  
WAILES

copper hydroxide will be dissolved by an excess. The precipitate then should be decanted several times with water to wash it, filtered off or allowed to settle, and finally spread out on a sheet of soft paper to dry. To make copper carbonate, sodium carbonate or sodium bicarbonate should be used in place of the ammonium hydroxide.

Dissolved in weak acids, the precipitates obtained will combine to form the corresponding salts of copper. For instance, if copper carbonate or copper hydroxide is added to a weak solution of nitric acid in excess, a copper nitrate solution will be formed. To obtain the copper nitrate crystals, simply allow the solution to stand and crystallize out. On the other hand, if hydrochloric acid is used copper (cupric) chloride will be formed.

Besides serving as an inexpensive source of copper oxide, copper nitrate crystals also form the basis of a particularly mysterious experiment. Moistened and wrapped in a sheet of tin foil, they will produce heat and cause the foil to curl and steam like a miniature crater.

Not only can copper compounds be made easily but they also can be broken down without difficulty to obtain the free copper. Copper oxide serves as a good example. Heated in a glass tube through which illuminating gas is passing, it will be reduced to free copper while the oxygen present will combine with the hydrogen in the gas to form water.

In the home laboratory, the amateur chemist can perform this experiment with simple apparatus made from a length of rubber tubing, a glass dropper, a pinch clamp, and a gas supply. As shown in the illustration, the copper oxide powder is placed inside the glass medicine dropper which is connected to a gas supply by means of a rubber tube. A pinch clamp placed over the tube provides a regulation for the flow of gas. It should be adjusted to give a half-inch flame at the end of the dropper when the gas is ignited.

With your apparatus arranged, hold the glass dropper in the flame of your gas burner or alcohol lamp. Soon, the copper oxide contained in the tube will take on the characteristic reddish brilliance of free copper and tiny droplets of water will be visible. The copper oxide then is said to have been reduced to copper.

YOU also can reduce copper oxide by mixing it with starch or sugar and heating it in a test tube. The carbon and hydrogen in the starch or sugar will steal the oxygen from the copper oxide and set the copper free as a reddish powder.

Still another way of producing copper from copper oxide can be demonstrated by heating a coil of copper wire in the outer flame of a gas burner until it becomes coated with a film of copper oxide and then immersing it, while hot, in a test tube of alcohol. The alcohol, containing carbon and hydrogen, will abstract the oxygen from the copper oxide and leave behind the pure copper. In this reaction, the alcohol will be oxidized to form various oxidation products, among them being aldehydes which can be detected by their peculiar odor.

As with other metals, copper chemicals color an open flame. A bit of copper chloride, for example, dusted into the air port of a gas burner or directly into the flame will tint the flame a beautiful greenish-blue. Thrown on the burning logs in an open fire place, they will present a vivid effect of soft color.

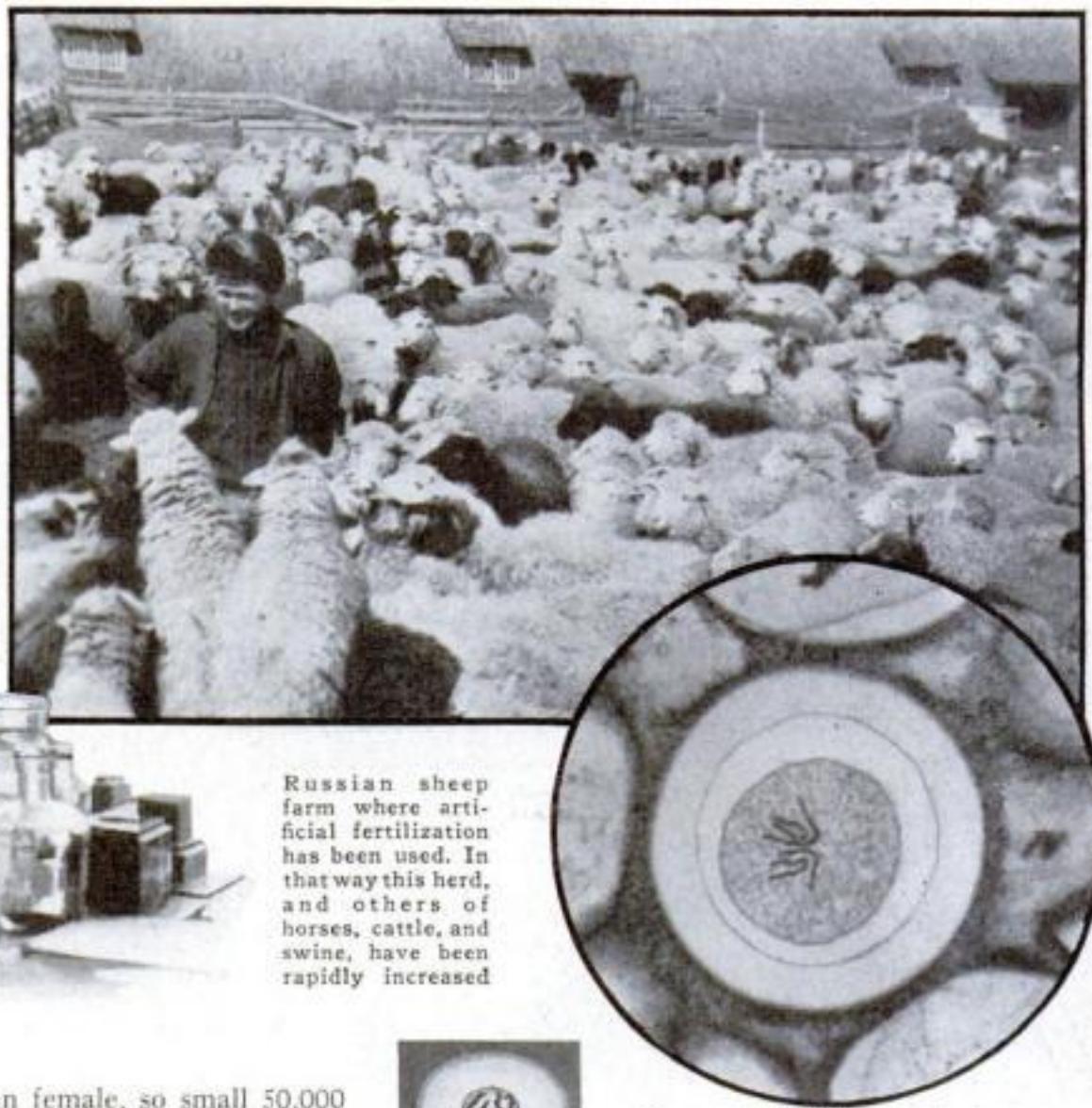
Free uncombined metallic copper, on the other hand, will not impart a lasting color to the (Continued on page 116)

# Electric Current Determines Sex

*Startling Discovery Enables Stock Raisers to Breed for Male or Female as They Wish*



Nicholas K. Koltzoff, Russian scientist, who has discovered a means of predetermining sex



Russian sheep farm where artificial fertilization has been used. In that way this herd, and others of horses, cattle, and swine, have been rapidly increased

**D**ETERMINING sex by electricity! Producing tabbies or Tom cats, cows or bulls, ewes or rams at will! Such are the sensational possibilities indicated by successful experiments in the laboratory of the famous Russian biologist, Prof. Nicholas K. Koltzoff.

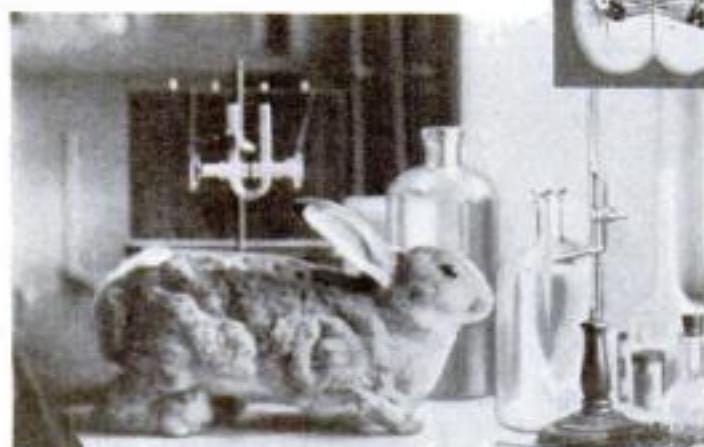
Tests with laboratory rabbits have shown that ninety times out of a hundred the sex of the offspring can be determined by the electrical method used by Prof. Koltzoff. His discovery now is being tested on an elaborate scale at government farms in Russia. If it proves as successful with sheep, hogs, cattle, and horses as it has with rabbits, it will enable dairy farmers to produce practically all milk cows, ranchers practically all beef steers. It will reduce the waste now occasioned by nature's haphazard methods of producing males and females by chance.

The basis of Koltzoff's work is the fact that the cells which make up the bodies of all animals are known to be electrically sensitive. The blood corpuscles of a shark, for instance, are attracted by the negative pole of a battery; those of most animals, by the positive pole. Might not the sperm cell of the male, which fertilizes the egg cell of the female and determines sex, also be affected by electricity? A little more than a year ago, Koltzoff began his pioneer experiments to answer this question.

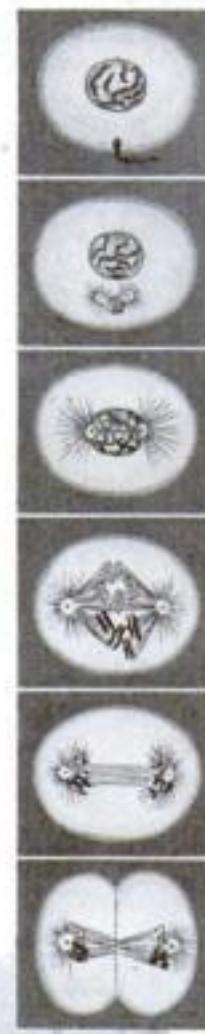
As all biologists now know, both the egg cell and the sperm cell contain microscopic rodlike particles known as chromosomes. They form the nucleus of the cells and are believed to transmit hereditary characteristics. The ovum, or egg cell of the

human female, so small 50,000 would hardly cover a postage stamp, contains twenty-four chromosomes. The spermium, or fertilizing cell of the male, smaller than the egg cell but equipped with a whip-lash tail with which it propels itself rapidly in tadpole-fashion, has either twenty-four or twenty-three chromosomes.

Koltzoff's guess, which may stand out as of prime importance in the history of biology, was that one kind of chromosome cells would be attracted to the negative pole of a battery, the other kind to the positive pole. To test the idea, he prepared a U-shaped glass tube with a shut-off valve near the bottom of each upright and a drain valve at the center of the horizontal section. Wires with terminals in each upright were connected with a storage



Experimental rabbit in front of U-tube used with electric current to separate male and female spermatozoa



Above, four hairpin-shaped chromosomes in a fertilized egg cell. Two are male and two female. Left, from top to bottom figures illustrate fertilization of an egg. The steps are: entrance of sperm, its approach to egg nucleus, union of nuclei, splitting of chromosomes, separation of chromosomes, division into two cells

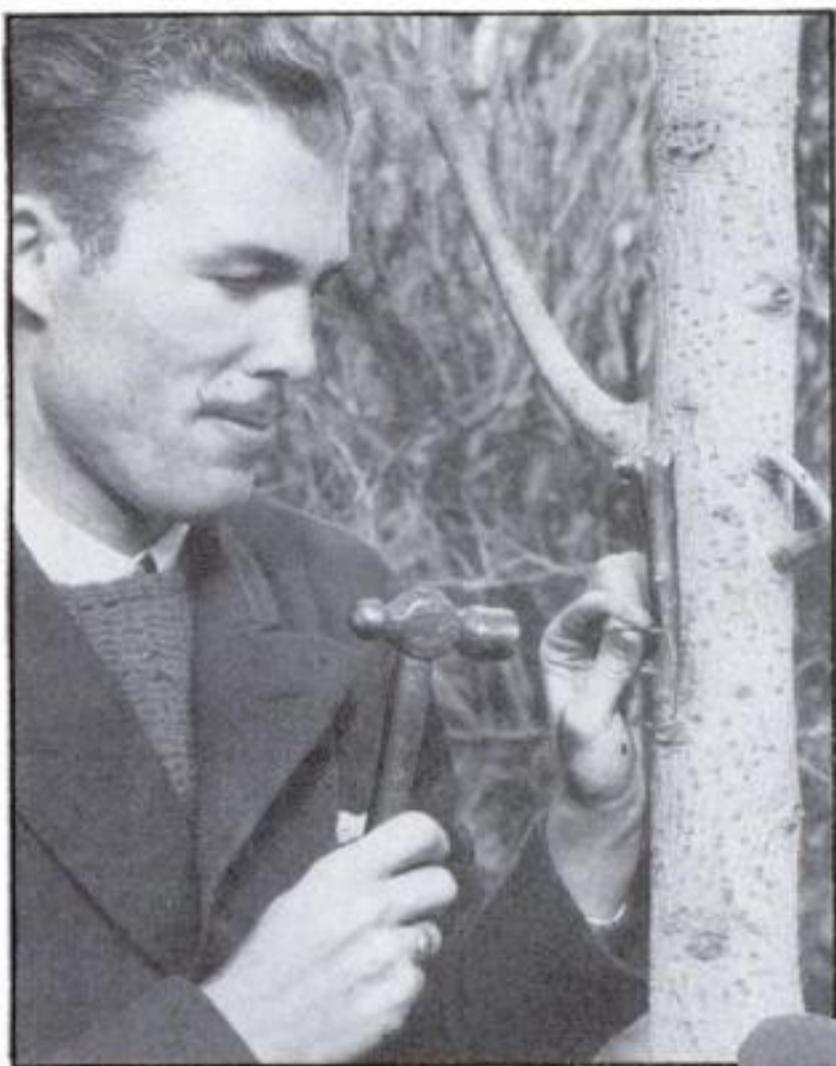
battery after the U-tube had been partially filled with a solution containing the male cells of the rabbit.

Watching intently, the scientist and his assistants saw the colorless liquid in the tube slowly begin to move. The fluid was agitated by millions of invisible spermatozoa, swimming like tadpoles, some heading at top speed for one pole, some for the other. Defying gravity, the liquid gradually rose up into the right and left vertical branches of the U-tube.

At the end of two hours, the fluid had disappeared from the horizontal section and hung, as if by magic, in the vertical tubes. It was about evenly divided between the two. Koltzoff closed the valves to prevent the liquid from running down and then cut off the current. Had the current divided the invisible cells into those which would produce males and those which would produce females?

This was his assumption. However, when he peered into the material in the two tubes through a high-powered microscope, all of the magnified "tadpoles" looked the same. Only by the artificial fertilizing of female rabbits with the spermatozoa from the two tubes, *(Continued on page 119)*

# Keep Your Trees Healthy with these SIMPLE RULES



NAILING A GRAFT

The author of this article is seen above, nailing securely in place with small nails, a graft he has made on the young tree. The graft was set in a slit cut in the tree at an angle of forty-five degrees. After it is nailed in place, close the wound with wax

By  
J. E. KELLY

TREES are like human beings. They require a balanced diet if they are to attain full stature. They shiver in cold, rejoice in the warmth, contract diseases, chafe at restraint, and respond to freedom and kind treatment by yielding beauty and food.

Anyone may preserve and develop his miniature orchard, larger plantation, or grove by observing a few simple rules. He may even assume the role of scientist successfully and increase the vigor of his stock by budding and grafting, by playing surgeon to relieve sunburn, a barkbound limb or trunk, or stunted growth.

Trees require exercise. Therefore, except where necessity arises, do not tie saplings too rigidly to stakes or encase them within frameworks of wood. As they sway with the wind, they build up a reserve of strength that later



RIGHT PRUNING

It is highly important that pruning be done in the right way. As is illustrated above, the limbs of trees should be cut flush with the trunk

PROPPING TREES

Where fruit hangs so heavy on the limbs it may break them, a temporary framework of wood, as shown, can be used. It is not the best practice, however, and may cause quick decay



will stand them in good stead when heavily laden branches impose constant strain on the trunk.

From peaches to palms, the former one of the easiest to nurture and the latter one of the most difficult, you can raise healthy specimens by observing the precautions which I have found practicable in treating thousands of trees in southern California.

Delicate as is their circulation system, trees will survive some amazing feats of home surgery. Not long ago I was called to the estate of a prominent Hollywood actor. Thirty-six fine fruit trees were dying, victims of frost. Sadly the owner expressed the belief that they never again would raise their bowed heads.

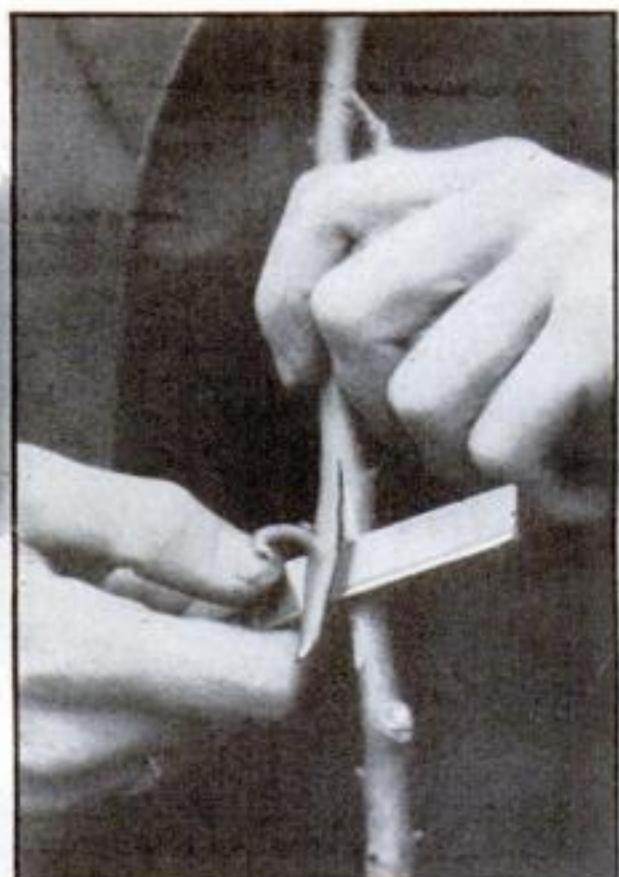
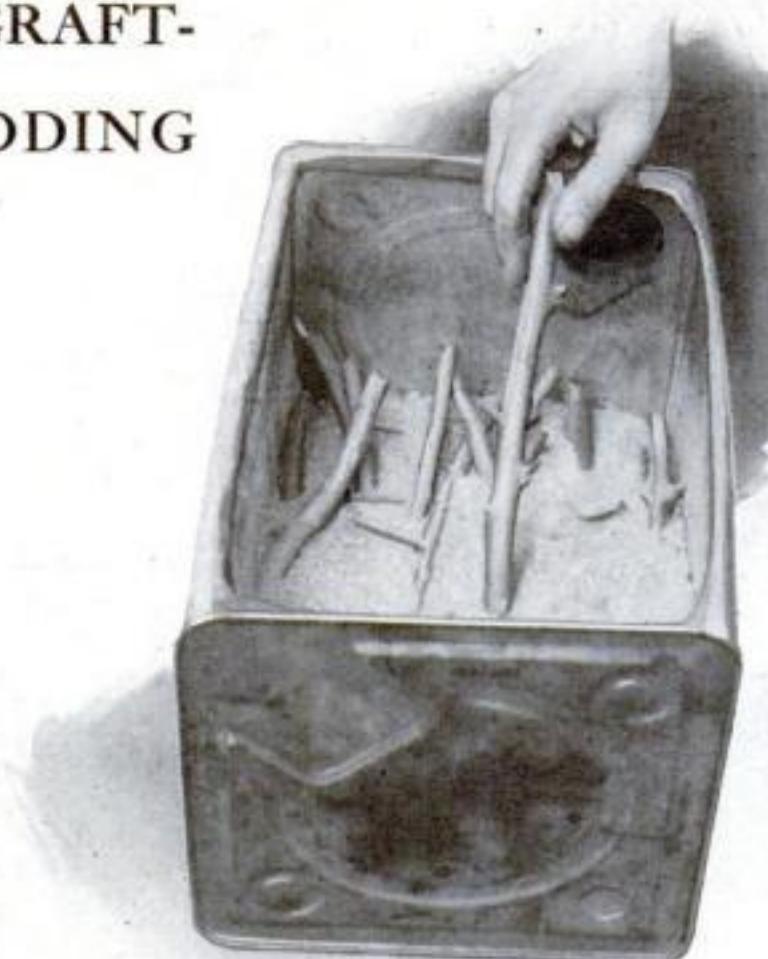
"Perhaps not," I said, "but let's try to give them new bodies and new heads."

In a few hours we had excavated holes at the bases, uncovering the root system where it joins the trunk. On them, at the

# EXPERT DISCLOSES METHODS IN GRAFT- ING AND BUDDING

## FIRST STEP IN BUDDING

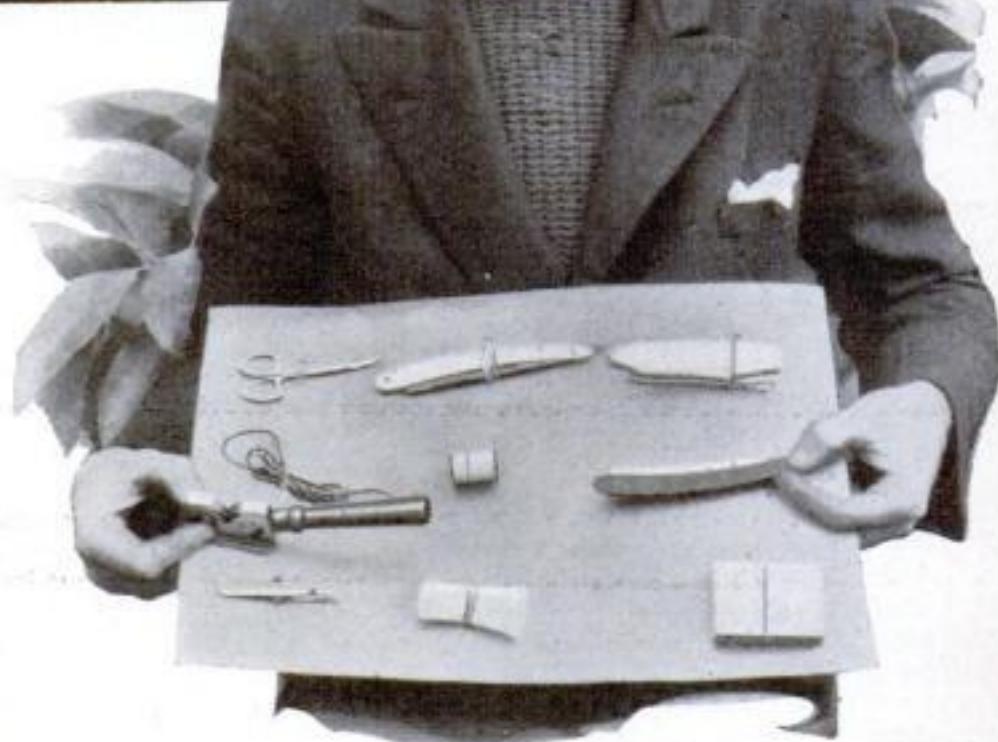
When you undertake a budding operation, it is important at the outset to select dormant buds from healthy saplings. To avoid later disappointment, test the buds for vigor by burying the cuttings in a shallow layer of damp sand. Cut away one side of an old five-gallon oil can and place the cuttings in it. After ten days the weak buds will drop off. Those that remain can then be used for budding in perfect safety.



**CUTTING OFF A BUD** After the cuttings have been buried for ten days, as told in the caption at left, a healthy bud may be removed from the scion with a sharp knife or razor, as is shown in the picture above. In this operation, care must be taken to select a strong specimen that has stood the test well.



**PUTTING THE BUD IN PLACE** Having selected a large bud with a base of wood and bark large enough to make a good union with the mother tree, the next step is to prepare the point of insertion. With a sharp knife cut a "T" in the bark large enough to receive the bud, as is shown at left above. Take care not to scratch the wood under the bark. Lift the corners of the cut and slip the bud into opening. The manner of binding the wound is illustrated at upper right. Generally a string binding or bicycle tape is used to hold the bud. A preparation of asphalt and wax serves nicely to seal the wound tightly.



**QUESTIONS WILL BE ANSWERED** Mr. Kelly will gladly answer any question pertaining to tree problems provided a self-addressed and stamped envelope is enclosed. Write him in care of POPULAR SCIENCE MONTHLY, 381 Fourth Avenue, New York, N. Y. At the right Kelly is seen with the instruments he uses in his work on trees.



#### HOW TO SAVE FRUIT CROP

At times fruit trees drop so many blossoms that an inadequate crop of fruit results. To avoid this, go through the orchard with manicure scissors and cut away the blossoms formed in clusters. This thinning will insure a heavier and far healthier yield of the fruit

**TO PLANT A SAPLING** After the hole is dug for a sapling, drive in the supporting stake, as shown at upper right. Then spread the roots and cover them with earth but do not tamp it down. When the hole is nearly full pour in ten gallons of water. Never fertilize the soil around the sapling roots

point of union between trunk and root, I grafted small scions of vigorous saplings, each about two and one-half inches long and half an inch in diameter. Then leaving the holes open, we left the sick trees to themselves. In a few weeks the grafts had grown above the level of the ground. At that time we filled the holes with loose earth. Soon all but two of the trees had responded and the next year the actor had a new grove, all root-grafted.

Grafting may take any of several forms. The root-graft was a side graft, the easiest method to apply. This ordinarily is used where you want a new limb without cutting the tree back. It may be done easily by cutting the scion on a bias, leaving a face about three inches long. Next, place the scion against the tree and scratch the outline with a knife. Now cut the bark as marked and strip it from the tree. With a chisel, step into the wood at an angle of forty-five degrees, the required depth, slip the graft into the slit, nail it tight with small nails and seal the wound with wax. Use the plumpest of last year's saplings for the scion and the more dormant buds on it the better.

Other forms of grafting are known as the wedge, bark, saddle, and cleft. Use the cleft system for small trees. Cut the tree off immediately above the last good-sized limb, leaving the limb to keep the sap feeding. Split the top of the trunk from side to side and insert the scions, making sure the cambium layer of cells abuts the same layer in the trunk. Otherwise, circulation will be lost. Here the scions should be cut down from two sides to a knife edge.

Where the trunk is large use the bark grafting method. Trim down one side of the scions evenly. From here on this operation is accomplished in about the same manner as a side graft, the difference being, first, that you step into the wood of the tree an even distance the entire length of the strips, instead of at an angle; secondly, you place grafts about six inches in length, most grafts being inserted from three inches to five inches according to the circumference of the stump. Nail the scions in place and seal with wax. Again the cambium layers must match.

The saddle and wedge grafts are really spliced grafts and are principally used to splice on freshly broken limbs.

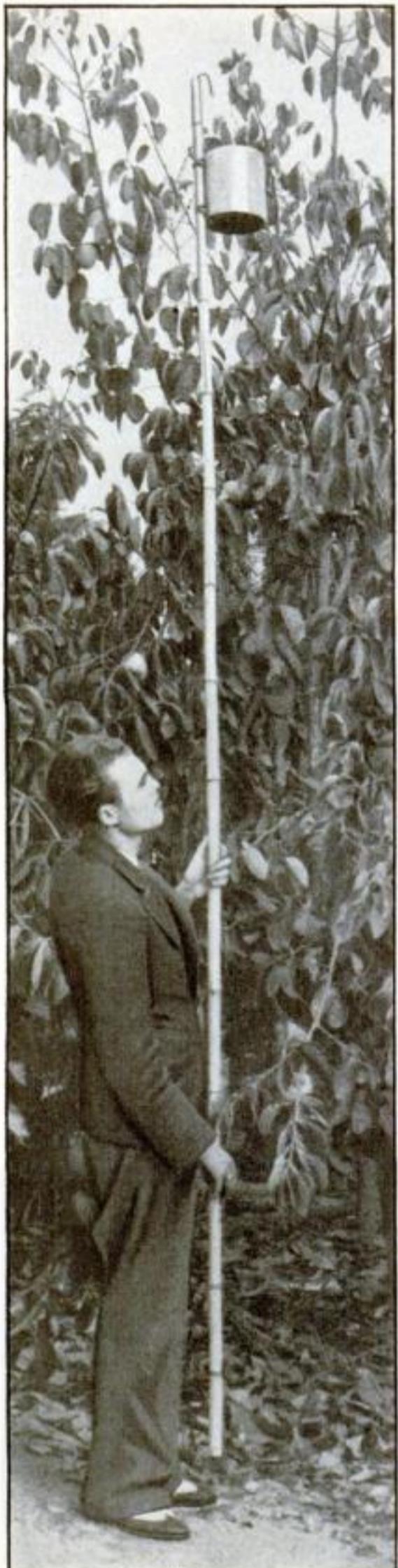
Budding may be accomplished easily and safely on trees less than three years old. On the more mature trees, it still may be done provided you are willing to cut away the superfluous growth. It is important at the outset to select dormant buds from healthy



**CARE OF TREE AFTER BUDDING** Actually, in budding, a new tree is created to take the place of the old one. Therefore, two months after budding, cut the tree back, removing about half the trunk above the bud. By degrees cut back the trunk until you have a four-inch stump. After final cutting, mold wax over wound and down the stump's side



**FORMS OF GRAFTING** Above are illustrated four forms of grafting in addition to the side graft which is described in the text. The cleft is used on small trees. With a large trunk, use the bark method. The saddle and wedge grafts are spliced grafts and usually are used to splice on broken limbs



#### HOMEMADE FRUIT GATHERER

The bent hook of a clothes hanger is fastened to the end of a long pole. A bamboo fishing rod is excellent for this purpose. To the hook attach a gallon pail, as is shown above. With this simple device it is easy to gather the fruit from a tree without damaging its high branches.

saplings. In order to avoid later disappointment, test the buds for vigor by burying the cuttings in a shallow layer of damp sand. An old five-gallon oil can with one side cut away will serve as an inexpensive container. After ten days, the heads of weak buds will drop off. Those that have not succumbed may be used with safety.

Many people have the erroneous idea that small buds will respond quickly to their new environment. Always use a large bud with a base of wood and bark large enough to make a good union with the adopted mother tree. With a sharp knife or straight edge razor split the bark at the point where the bud is to be inserted and shape a "T" large enough to receive the bud. Take care not to scratch the wood under the bark. This is important, as scratching hampers the circulation at that point.

Having cut the "T" lift the corners of the cut but do not spread the bark to the point where the bark cracks. Now you are ready to slip the bud into the opening. Force the edge of the bud base about a quarter-inch under the bark, permit the bark to adjust into place, then press the bud down until it is flush with the wood base.

There are two good ways to bind the wound. The more common calls for a string binding, winding it around the tree until taut. This will hold the new member in place, while any commercial wax preparation containing resin, tallow, and beeswax will guard it against exposure. Or you can wrap the tree with bicycle tape and cover this wrapping with a sealing preparation of asphalt and wax. I have found the latter a satisfactory method, as the asphalt holds the wax base intact when sudden weather changes might cause the resin mixture to crack and open.

On the average tree, loosen the bindings eight weeks after it has been applied. Do not remove it entirely, but loosen it gradually and at periods covering two months, when the union should be completely bared. This will permit the bark to expand gradually, yet will prevent it from popping open.

Ordinarily, in budding you are creating a new tree to take the place of the old. Therefore, two months after budding, begin to cut the tree back. The first cutting should remove about half the trunk above the bud. Then, by degrees, cut back the trunk twice as far as the length of the bud

until you leave only a four-inch stump above the point of insertion. After each cutting seal the open wound with a wax preparation. After the last cutting mold the wax at least an inch down the sides, thus creating a cap. At this time you can tie the bud with gauze tape into an upright position, using the stub as an anchor. When new growth is sufficiently strong cut off the stub.

Practically every fruit tree coming from a commercial nursery is budded. In fact, to attain vigorous growth, you either must bud or take a third generation seedling. Provided you cap the stub properly and scrape away any buds or blind buds to prevent wild growth, you should have no troubles from this scourge.

In cases where fruit weighs heavily on the limbs, use a framework of wood for temporary propping. We have learned during the last two years, however, that such frameworks hamper the growth of most trees as the props may mar the limbs at points of contact. Decay sets in or, at best, the branch, like a human member, loses its ability to support itself. You can liken the situation to the wearing of a brace and resulting atrophy of muscles.

By the more modern system of cross-bracing, the tree supports itself, the main trunk both bracing and supporting the branches. Here you cross-wire the smaller limbs so that they are supported by the larger, which in turn are supported by the trunk. In using wire, be sure to protect branches and trunk at points of contact with sections of old rubber hose. Your tree will resemble a broadcasting tower, but this method lessens damage, yet leaves enough support for the limbs while not hampering their strength and permitting the tree to give with the wind.

Irrigation is a problem common to all groves, whether of four or 400 trees. How shall I water and how much shall I use? The amount of water depends on the weather and type of soil. No rule of thumb can be universally applied. The hardest situation to meet is that where trees grow in adobe or over a hard base. Here too much water is definitely harmful. In any event, keep the water out far enough from the tree base to avoid souring of, or interfering with, the top roots, which grow close to the surface near the trunk. Trees planted in decomposed granite or soil with loose base generally require a great deal of water.

*(Continued on page 114)*

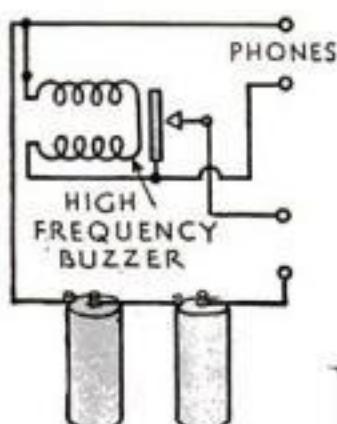


#### HOW TREES NEAR A CURB ARE SAVED

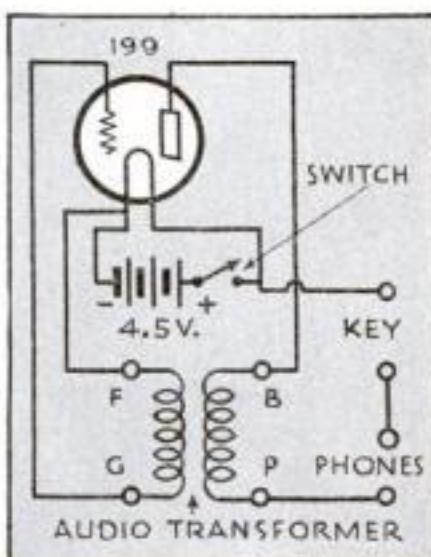
When trees are growing against a curb, their lives may be lengthened by installing a cut-away steel curb, as shown at the left. In this way they are given more room. To water such trees, dig a trench in the shape of a horseshoe around three sides of the tree and out at the end of the branches.

# New Ideas for Radio Handy Man

*Practical Suggestions Contributed by Our Readers*



At left and right are shown circuits for two set-ups that can be used in practicing the code. In this way, even if you have no amateur transmitter, you can become familiar with code signals



## Why You Should Learn the Code

EVEN though you may never expect to own an amateur transmitter, you are missing some of the best bets in the short-wave bands unless you know the code. An entirely new world opens, when you have learned the meaning of dots and dashes.

Of course, the code can be learned merely by memorizing the list of symbols as given in any good book on radio but the work will be greatly simplified if you will supply yourself with some sort of code practicing outfit. The circuits for two practice sets are shown in the drawings. Simplest of all code-practice circuits, of course, is the simple high-frequency buzzer. Connected to a battery

supply, a key, and a pair of earphones, you and a friend can send to each other and get the feel of hearing the signals through earmuffs, as earphones are called. If you desire a more advanced outfit, you can construct the simple one-tube oscillator also shown. With it, you will hear the signals just as they sound when received over the air.

If you have a regenerative short-wave receiver, you can use it to practice sending as well as receiving. Simply disconnect the antenna, substitute a large grid-leak resistance for the one already in the set, place a key in the B battery supply, and listen in through the headphones. Each time the key is closed an oscillation will be heard in the phones connected in the usual manner.—L. K.

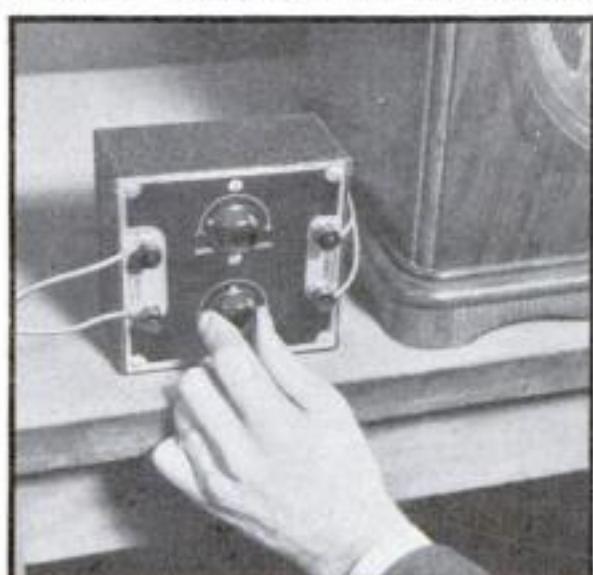
## Antenna Coupler for All-Wave Receivers

DESIGNED as an auxiliary unit for modern all-wave receivers, the variable antenna coupler, shown at the right, now makes it possible to use a tuned doublet receiving antenna on a variety of wave lengths.

To the short-wave fan, the doublet antenna and its noise-reducing lead-in are nothing new. Primarily it is a tuned system, designed to operate most efficiently on some selected wave length, generally within the amateur short-wave band. However, when used with an antenna coupler of this type to maintain an equal balance, the tuned doublet antenna becomes equally valuable for all-wave reception.

The unit consists of a variable condenser, two lightning arresters, and a variable coupling coil mounted in a shielded metal cabinet. The variable condenser makes it possible to keep the transposed lead-in in balance under all conditions and

the variable coupler provides greater selectivity between stations. It forms an inexpensive addition to any all-wave set.



Variable antenna coupler makes it possible to use tuned doublet antenna on many waves

## Soldering Aluminum

AMATEUR set builders who have avoided soldering connections to aluminum panels or chassis because of the difficulty of making the solder stick now can make use of a new foolproof flux-filled aluminum solder. With it, strong aluminum joints can be made as quickly and easily as ordinary soft-solder connections.

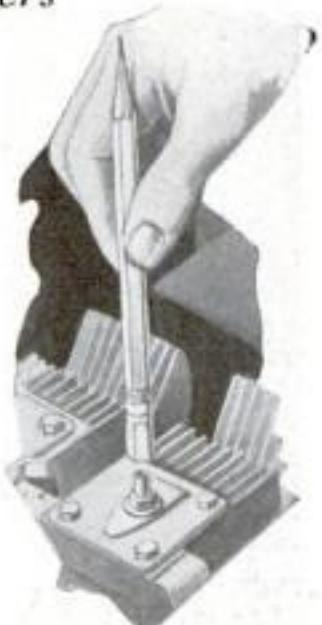
Like ordinary soldering, the main trick in aluminum soldering lies in cleanliness and flux. First, both the wire and the point of connection on the aluminum must be cleaned thoroughly. For this, a wad of fine steel wool is included in every package of the solder. Then both the soldering iron and the wire must be "tinned" with a thin coating of the aluminum. Finally, the work must be heated and the right amount of solder melted to form the joint.

## Improvised Wrench for Condensers

WHEN adjusting the balancing condensers on a super-heterodyne receiver, the special, small-size socket wrench necessary to do the job properly is not always at hand. A suitable tool can be improvised, however, by altering an ordinary five-cent lead pencil.

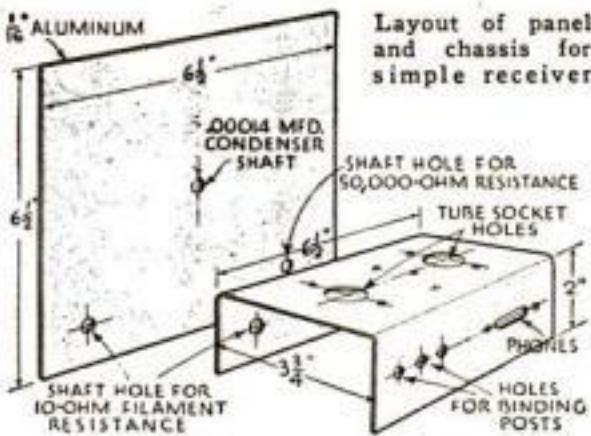
First of all, obtain a hexagonal pencil, one that comes with an eraser attached. Remove the brass eraser fitting from the end of the pencil, dig out the eraser with the point of a knife or a pair of scissors, and finally, after reversing the fitting, force the end which originally held the eraser over the pencil. To do this, it may be necessary to shave a little wood from the corners. Being reversed, the hexagonal socket which gripped the pencil will form a made-to-order socket wrench that will just fit the balancing adjustment. To insure against any possible short-circuits, wrap a strip of ordinary adhesive tape around the exposed metal at the end of the pencil.

Incidentally, a pencil altered in this way is a handy tool for the vest pocket of every service man. A pencil must be carried anyway.—A. W. A.





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radio parts. Of course, if he desires, he can wind his own on forms made from the four-prong bases of discarded tubes.

If the coils are homemade, they should be wound to the following approximate specifications: Fifteen- to forty-meter coil, three turns of No. 18 wire in the grid winding and three turns of No. 28 in the tickler. Forty- to ninety-meter coil, eight turns of No. 18 in the grid winding and ten turns of No. 28 in the tickler. Ninety- to 200-meter coil, twenty-four turns of No. 22 wire in the grid winding and fifteen turns of No. 28 in the tickler. For the broadcast band, the grid winding should have eighty turns of No. 28 wire and the tickler fifteen turns of the same wire. If necessary, the tube bases can be lengthened to take the windings by building them up with stiff paper (P. S. M., Mar. '34, p. 60). In each case, the wire should be of the double silk-covered variety and the lower end of the tickler winding should be spaced one eighth of an inch from the upper end of the grid winding.

Should the coils fail to cover the wave bands desired, the cure is to alter the number of turns slightly. Minor adjustments also can be made by spreading the grid windings a trifle.

The battery supply consists of two one-and-one-half volt dry cells connected in series and a single forty-five-volt B battery. Since the '30 tube requires but two volts, the filament rheostat should not be turned full on when the batteries are new and up to their full rating.

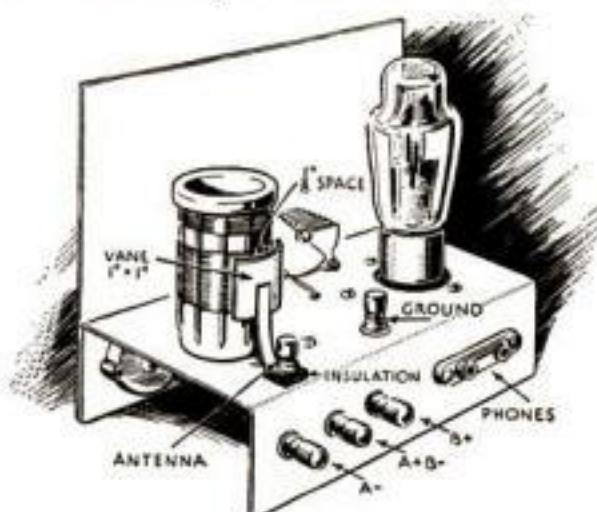


Illustration above shows an alternate method of constructing the one-tube short-wave set.

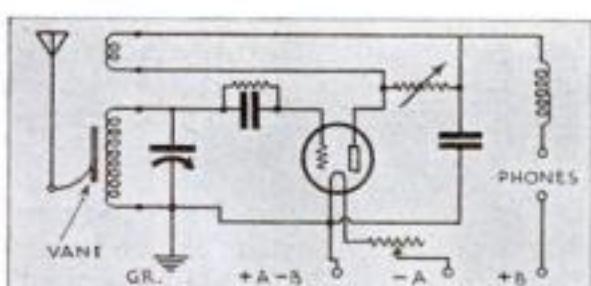


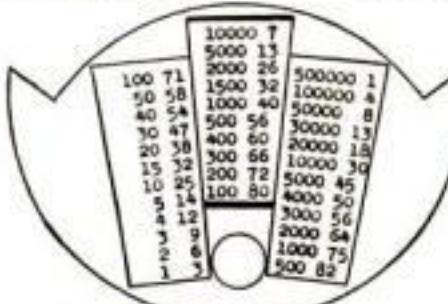
Diagram of wiring circuit when metal vane coupling arrangement is used in the receiver

# Three-in-One Meter

EASILY MADE FOR  
RADIO TESTING



Right, radio test box to measure voltages and resistance. Below, front view of test box panel with meter and switches for changing circuit.



Resistance conversion scale for making low, medium, and high readings

**S**ERVING as a voltmeter, a milliammeter, or an ohmmeter, the multi-purpose test box shown forms a valuable unit for the amateur experimenter. It can be made easily and quickly, is inexpensive, and provides an accurate means of making the many point-to-point measurements that are necessary in receiver construction and repair.

Through an ingenious combination of circuits, a 0 to 1 D. C. milliammeter is made to measure voltages and resistances as well as amperages. Also its range can be extended to cover a wide variety of readings. By means of ordinary toggle switches, the meter circuit is quickly altered to give the desired measurement.

For compactness, the switches, meter, and test-lead plugs are mounted on a five- by six-and-one-half-inch pressed wood composition panel which is set in a two-inch deep case supplied with a leather handle. The case can be made of wood or a second-hand molded composition meter or tube-tester case can be purchased cheaply if desired.

As shown in the photograph, the left-hand row of switches is for milliampercere readings, the right-hand row for resistance readings, and the bottom row for voltage readings. To the right of the voltage switches is a

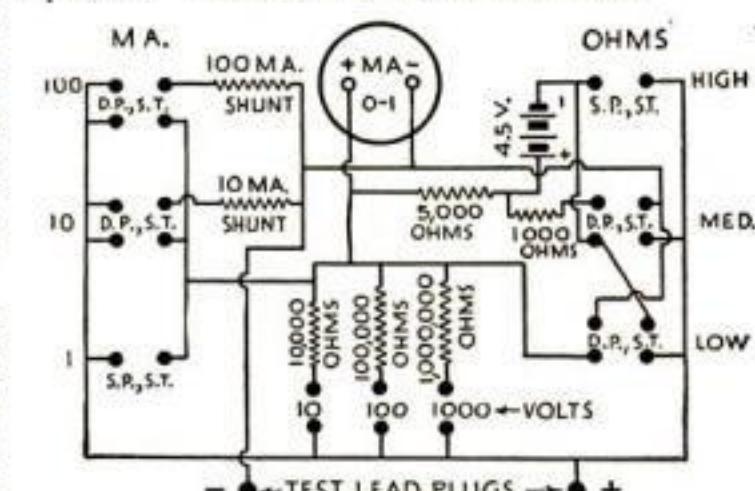


Diagram of circuits showing both single-pole, single-throw and double-pole, double-throw switches

fourth switch. This is a dummy installed to allow for future improvements. The switches are arranged so that the toggle arms slope toward the meter when in their neutral positions.

The seven resistors and the four-and-one-half-volt battery are mounted inside the case. If bobbin-type resistor units are used, they can be stacked on brass bolts in the lower corners of the case. No matter what type of resistance units are used, however, they should be wire-wound and accurately calibrated.

To simplify the resistance readings with the milliammeter, the conversion table shown should be mounted under the meter glass. Each table contains two columns of figures; the left-hand column indicates the resistance in ohms and the right-hand meter readings in hundredths of a millampere.

Voltage and milliamperé measurements can be read directly from the meter after the full range of the scale has been converted to agree with the markings next to the switch that is in operation. In each case, start with the switch giving the largest scale and work down—D. H. VOLLMER.

# Tuning Up Car for Summer Use

**G**US WILSON looked more like a painter than the owner of the Model Garage when Ned Stanton, a neighbor, dropped around to see him one holiday afternoon. The gray-haired mechanic had just finished touching up the trim on his neat, two-story house.

"I started some spring cleaning too," Ned said, admiring Gus's handiwork. "Only I haven't been particularly successful so far."

"Painting?" inquired the garageman.

"Nope, I wish it was. It's that blamed car of mine. I wanted to give it a spring tune-up but all I've managed to do was drain out the anti-freeze and flush the radiator. I didn't know just where to begin."

"Well, you made a start anyway," grinned Gus, wiping spots of paint from his large hands. "Wait until I stick this brush into some turpentine, and I'll run over and take a look at it."

"A funny thing," said Ned as they walked to his garage. "When I was flushing out the radiator during that warm spell a couple of weeks ago, the water didn't seem to run through very fast. I couldn't stop it from gushing out of the top of the radiator where I had the end of the hose."

"Out of the top of the radiator where you had the hose?" repeated Gus.

"Sure, I just stuck the end of my garden hose into the filler opening, opened the drain cock under the radiator, and then turned on the water," Stanton explained. "What's wrong with that?"

Gus's deep chuckle boomed through the driveway. "No wonder your radiator acted like a gusher," he said with a grin. "What did you do about the water thermostat?"

"Thermostat?" echoed Stanton, puzzled. "I didn't know the car had one."

"About seven out of every ten cars have one," corrected Gus. "It's a valve controlled by the heat of the cooling water that stops the circulation until the water gets hot. It helps in making cold-morning starts. When the cold water from that garden hose hit your thermostat she just closed up like a clam. It was like trying to force water through a stone wall. And another thing, Ned, you can't clean a radiator by stuffing a hose in the filler hole. Get me a pair of pliers and I'll show you."

## Flush Radiator First, but Don't Forget Brakes, Coils, and Valves

By MARTIN BUNN



"At ordinary temperatures," said Gus, lifting the thermostat out of the hot water, "that valve is closed tight. When it's working as it should, it is wide open at 180 degrees."

With the tool, Gus proceeded to loosen the four metal clamps that held the radiator hose connections in place. Then he tackled a few screws near the top of the radiator and finally lifted out a cylinder of metal that looked like a stack of large-size washers. "This is the thermostat," he said, holding the part up so Stanton could see it. "And one of the first jobs in flushing a radiator is to clean this little heat valve with gasoline and then test it."

"But how the dickens am I going to test a thermostat?" inquired Stanton. "I haven't got any tools for that sort of work."

"You've got everything you need," replied Gus. "Just let me use your kitchen for about ten minutes."

Stanton led the way through the back door of the house to the kitchen. Gus cleaned the thermostat with some gasoline borrowed from the car, then asked Ned for a large pot of water.

"Now," he said as he placed the kettle on the stove, "we're ready for the test. The first thing we'll do is hang the ther-

mostat in the water so it doesn't touch the bottom of the pan where the heat would be too great. We can do that by looping a string around it and supporting the string on this screwdriver placed crosswise on the rim of the pot.

Then we'll light the burner and wait for the water to heat up."

When a faint mist of steam rose from the water, Gus motioned to Stanton to watch the valve at the end of the thermostat. Gradually, as the water got hotter, the tiny valve opened wider and wider until at last, when the water was boiling, a space at least a quarter inch in width could be seen all around the head of the circular valve.

"At ordinary temperatures that thermostat valve is closed tight," explained Gus. "But when it's working as it should, it starts to open up at about 140 degrees Fahrenheit and is wide open at about 180 degrees. Sometimes they get stuck during the winter. If they do, they'll cause all kinds of overheating troubles in the summer. If it doesn't open when the water boils, it's good proof that it's either broken or jammed."

"How do you go about fixing them when they're broken?" asked Stanton with interest.

"There's no sense trying to fix them," replied Gus. "If trouble shows up in the test, the best thing to do is to put in a new unit. Of course, you don't need a thermostat in the summer, but they sure help on cold mornings."

When the two men once again were in the yard standing beside the opened hood of Stanton's car, Gus proceeded to demonstrate just how a car's cooling system should be flushed.

"To make a good job of it," he began, "the first thing to do is to use some sort of cleaning solution. There are lots of them on the market or, if you want to, you can use a plain washing-soda mixture; about a half pound of soda for every gallon of water. Put that in your radiator and run the motor for about ten minutes to force it all through the system."

"Then drain your motor and radiator, pull out the thermostat, test it and clean it, and then remove both hose connections. When that's done, you're ready for the actual flushing. (Continued on page 111)

# THE HOME WORKSHOP

MODEL MAKING : HOME WORKSHOP CHEMISTRY : THE SHIPSHAPE HOME



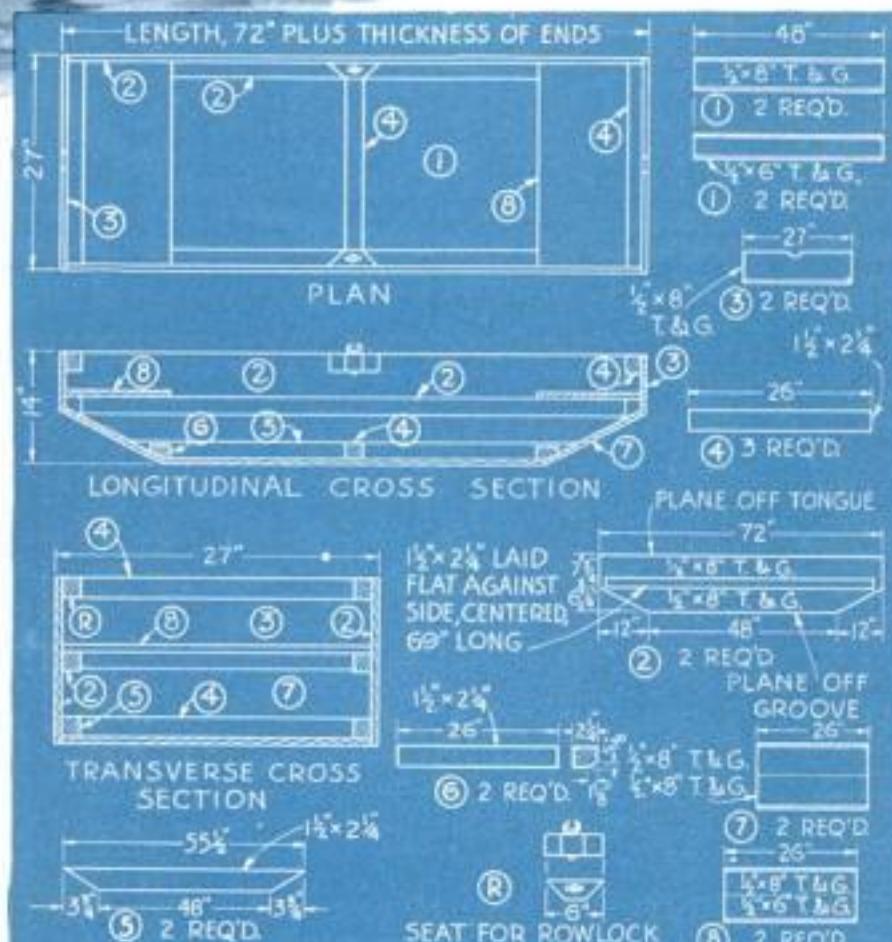
Although it weighs only a trifle more than 66 lb., this little punt will support 500 lb. in the water

**Y**OU can make life more enjoyable for your boy this summer, if you happen to live near a bay, lake, or other waterside, by letting him build a small lake punt similar to those used on the Serpentine in London, England, or on the English lakes.

The punt illustrated is one that my 13-year-old son helped me build. It will support 500 lb. in the water, yet children can carry it, turn it over when necessary, and launch it unaided. It may even be used as a platform from which to dive. I made the oars, too, aided by information previously published in this magazine on a paddle (P.S.M., Dec. '32, p. 84).

The punt weighs a fraction more than 66 lb. The cost of lumber was \$2.80, hardware and putty \$1, and paint \$1.20, although prices will vary to some extent according to the locality and the grade of materials selected. The construction required 24 hours.

The drawings are self-explanatory, but a few hints may be helpful. White pine lumber may be used throughout because it is so easy to work and can be obtained already tongued and grooved. The parts are nailed together except in a few vulnerable points at the corners and where



The punt is made mainly of tongued and grooved white pine with putty in all the joints

By  
WILLIAM  
H.  
ROBBA

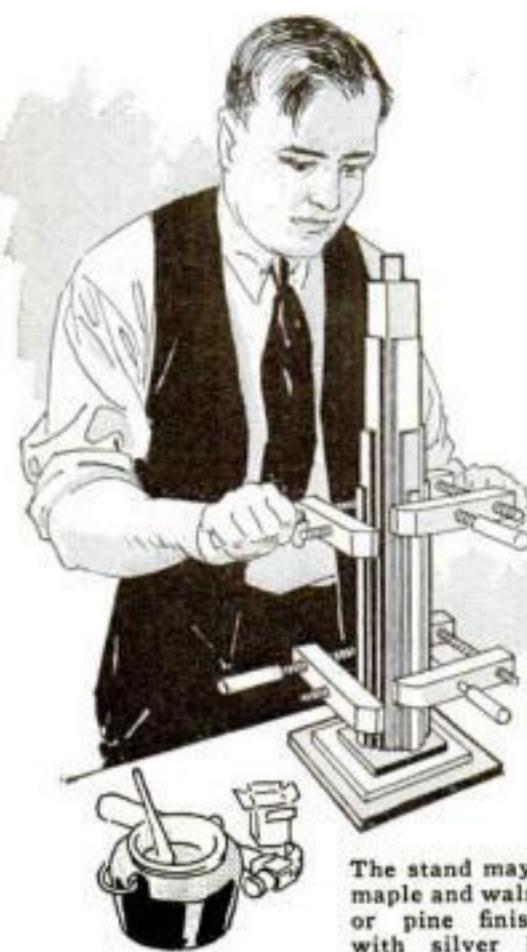
two sides meet at an angle.

Seam composition or putty of a type sold for hull construction should be applied liberally. In the absence of a prepared composition, mix two parts of paste white lead and one part of whiting. Apply the putty in the grooves and on the tongues and in all seams, and squeeze the surplus out by using carpenter's clamps. Scrape off the surplus putty for use elsewhere. Set the heads of the nails  $\frac{1}{8}$  in. into the wood and fill the holes with putty.

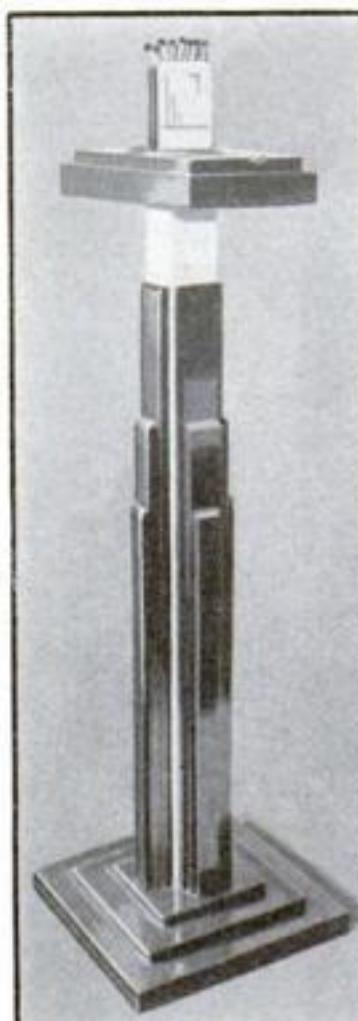
Give the punt three coats of good quality paint, preferably of a grade sold for boats. Any cracks or seams that have been overlooked should be puttied after the priming coat. It is best to apply the coats about a week apart so that the paint will dry thoroughly. Bear (*Continued on page 88*)



## Two-Toned Smoking Stand Built Like Setback Skyscraper



The stand may be maple and walnut, or pine finished with silver leaf and black lacquer



**I**N THIS unusual smoking stand, the beauty of the setback skyscraper design is enhanced by the use of two or more contrasting colors in the finish.

First get out a center post  $1\frac{1}{2}$  by  $1\frac{1}{2}$  by 24 in. Turn down the ends of this piece as shown to fit 1-in. holes in the base and top (or cut square tenons if a lathe is not available). This post should be of light-colored wood or of pine covered with sil-

ver leaf. The remainder of the stand is of dark wood or pine lacquered black. Make the base from one piece  $\frac{3}{4}$  by 8 by 8 in., another  $\frac{3}{8}$  by 6 by 6 in., and a third  $\frac{3}{8}$  by 4 by 4 in. These are glued and bradded together. Bore a 1-in. hole through the center of the base, insert the center post, and glue it in place.

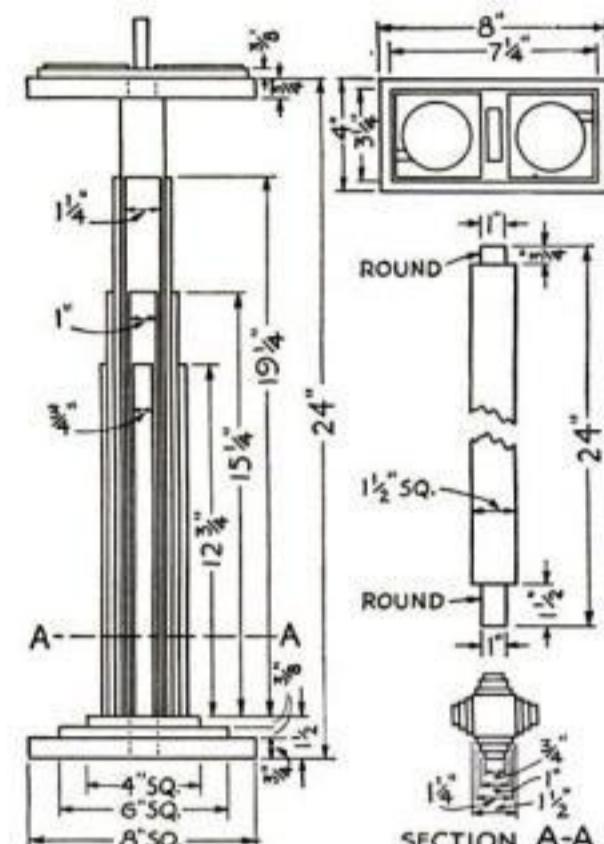
The twelve  $\frac{1}{4}$ -in. laths used to build up the setback effect are next sawed and planed to the dimensions shown, then glued and bradded in place on the center post.

Cut a piece  $\frac{3}{4}$  by 8 by 4 in. for the top, and bore a 1-in. hole at the center.

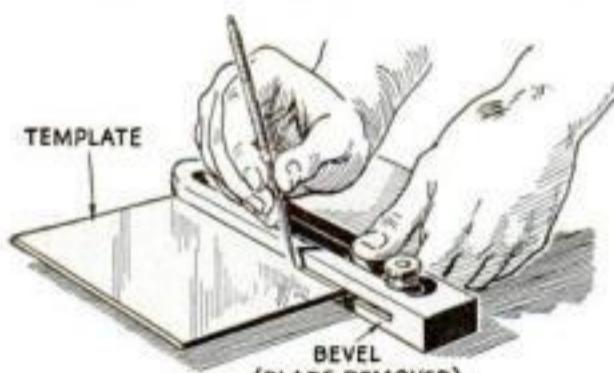
Set this on the post and fasten with glue, being careful to square it with the base. Now obtain two small individual ash trays such as are sold in sets at novelty stores. Cut a board  $\frac{3}{8}$  by  $\frac{3}{4}$  by  $7\frac{1}{4}$  in. and, with a coping or jig saw, cut two holes to fit the bottoms of the trays. Glue this piece in place on the top. A suitable match box holder may be made or purchased and secured between the trays.

In laying silver leaf on wood, it is important that the wood be as smooth as possible. It is advisable to fill the wood with a paste wood filler, then sand it smooth with No. 4/0 sandpaper. Next give it a coat of good varnish thinned with turpentine. Allow this to form a hard, tacky surface before applying the leaf.

If two woods of contrasting color, such as maple and walnut, are used, finish the piece with white shellac, clear lacquer, or varnish.—HARRY R. STABLER.



How the stand is assembled, a cross section, and details of the center post and top part



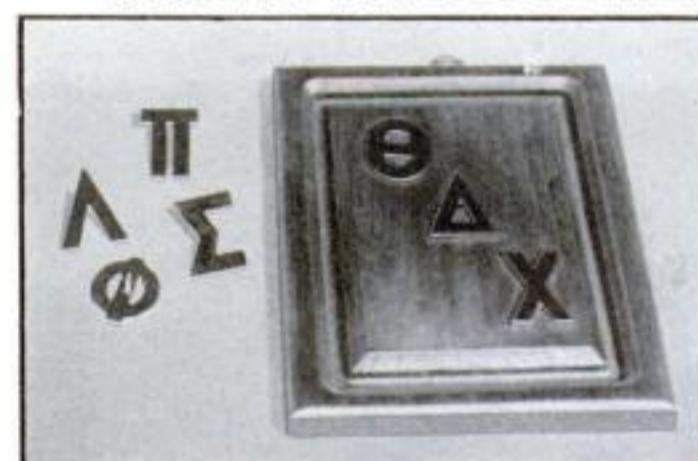
The stock of an ordinary bevel may be used to transfer center lines on thin templates

### SCRIBING CENTER LINES ON THIN TEMPLATES

BY MAKING use of the slotted stock of a common bevel, you can quickly transfer the center line of a thin sheet metal template to the reverse side. Remove the blade of the bevel and slide the lock nut toward the butt end of the stock. The opening in the bevel stock in most makes of bevels will receive sheet metal up to .050 in. without damage to the tool. Therefore slip the stock on the template, keeping one edge close to the center line, that is, a scribe point away. Tighten the lock nut, turn the template over, and scribe the center line on the reverse side.

This method will be found convenient and accurate in cases where templates must reverse to check the filing of sweeps and radii, as, for example, in automobile body work.—ROBERT WELLER.

### PROFIT IN JIG-SAWED METAL WORK



**W**ATCH fobs, plaques, and other ornaments may easily be cut out on your jig saw. As made-to-order pieces of this sort are in demand, such work may often be sold.

The fob illustrated consists of three initials worked out within a shield. The outline is drawn on sheet brass, holes are drilled where necessary, and the design is sawed out on the jig saw with jeweler's saw blades. The outline is completed with a small cold chisel. The piece is then finished with a file, and polished and lacquered.

The Greek fraternity letters shown in the second photograph may be made in any size and applied to plaques. A hole is



drilled through the letters with a No. 20 drill. A No. 14 brass escutcheon pin is cut off, and the upper end is turned or filed down to fit the hole. It is then riveted into the hole, and the top is filed smooth.—D. H.

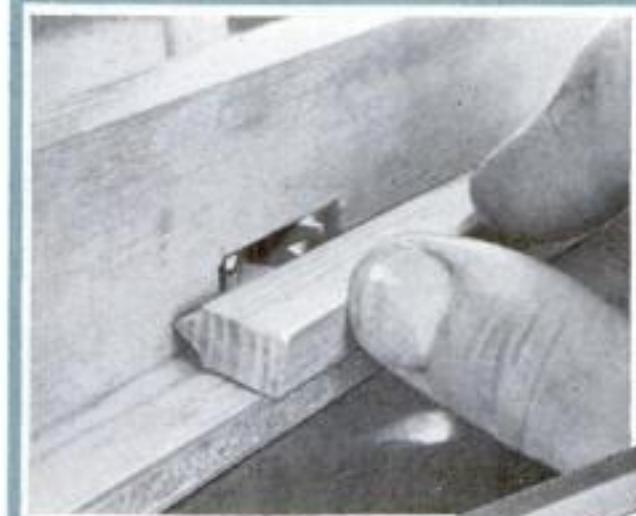


Suggestions for making fobs and plaques

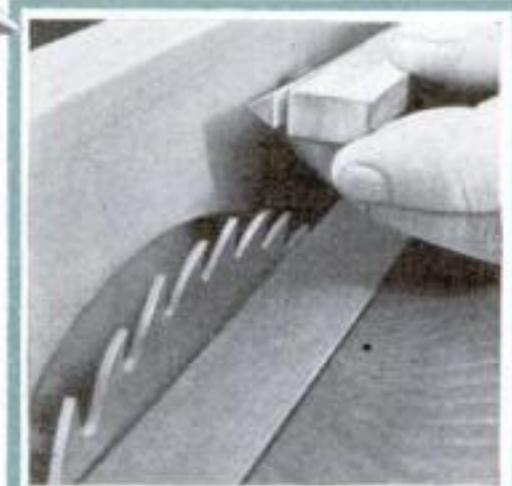
# Homemade Casting Rod

MADE  
STRONGER BY  
WIRE CORE

By Kenneth Murray



How segments are shaped, and the special V-shaped cutter used in the process



After one edge of each strip has been shaped with the cutter, the piece is ripped on a circular saw

IT'S GREAT sport to cast for the big ones with a rod you have made yourself. This one is tough, flexible, and springy. The important parts can be made on a drill press if you haven't a shaper. The rod consists of six strips of hickory and osage orange, alternating, with a length of stiff piano wire for the core.

In choosing the wood, get strips 40 in. long, several inches wide, and  $\frac{3}{8}$  in. thick. The hickory should be well seasoned—preferably a piece that has dried naturally for several years instead of being kiln-dried. Select yellow osage orange, so popular in making archery bows; the white part, from near the bark, is not so strong.

If a V-shape cutter is not available, it may readily be made from a blank. The angle of the cutters is the same as that of a triangular file. After passing the strip against the cutter as shown, the triangular piece is cut off on the circular saw to give 40 in. long segments of exactly the size shown in the diagram. If the triangular strips are of this size, they will, when assembled, accommodate a music-wire core of No. 19 standard gage. The inside edge of each segment may be very slightly trimmed down if larger wire is used. Music wire of any size from No. 18 to 21 (standard gage) or No. 12 to 15 (music-wire gage) may be used according to the flexibility desired.



A rod made by this method is remarkably strong, flexible, and tough. The exact size of the segments is shown at the left. In circle: How they are put together



To obtain uniform pressure when binding the segments, a weight is hung on the cord and the glued-up rod is revolved slowly and evenly

of about  $\frac{7}{16}$  in. Round the latter with sandpaper to fit loosely in the handle.

Place some very thick waterproof casein glue in the socket of the handle. When the rod is pushed in, all excess glue will be expelled and may be wiped off. The joint may be further refined in appearance by smoothing with a little composition wood.

The regular hardware (tip, guides, grip, and reel) may be purchased or taken from an old rod. Winding with silk has been described in previously published articles. Give the windings a very light coat of shellac before varnishing. The latter operation should be done while the rod is suspended by the tip, and it is preferable to use a number of coats of thin, high-grade weatherproof varnish than several coats of thick varnish.

The colored segments give the rod an attractive appearance, and it has proved its value during much strenuous fishing.

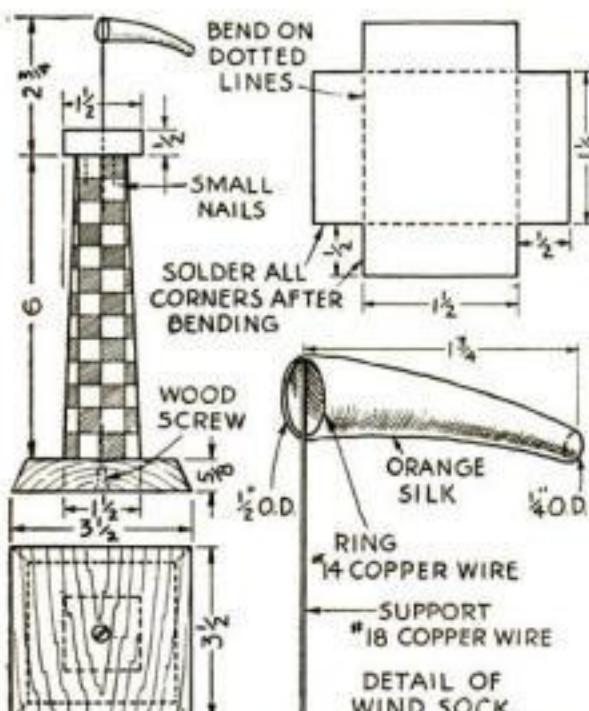


### SMALL AIRPLANE MODEL MOUNTED ON PYLON

THE miniature pylon illustrated above was designed as a mounting for a 4-in. model of a racing plane. The pylon and base are made of white pine, and the judges' stand on top is of tin. The wind sock is of orange silk with a framework of copper wire. The model was mounted by means of three fine piano wires. In order to give a sense of motion, a celluloid disk of the same diameter as the propeller was substituted for the "prop."

The drawing below is self-explanatory, but the dimensions may need changing to adapt the pylon to individual requirements.

The base, the inside of the judges' stand, and the wind-sock support and mounting ring are painted black. The pylon and the outside of the judges' stand are checkered in chrome yellow and black. The steel wires supporting the ship may be left "as is." Holes for the wires should be drilled first. For a small, light ship it will not be necessary to weight the base. After painting and assembling, glue a piece of thin felt or thick cloth to the bottom of the base.—J. L. SPRAGUE.



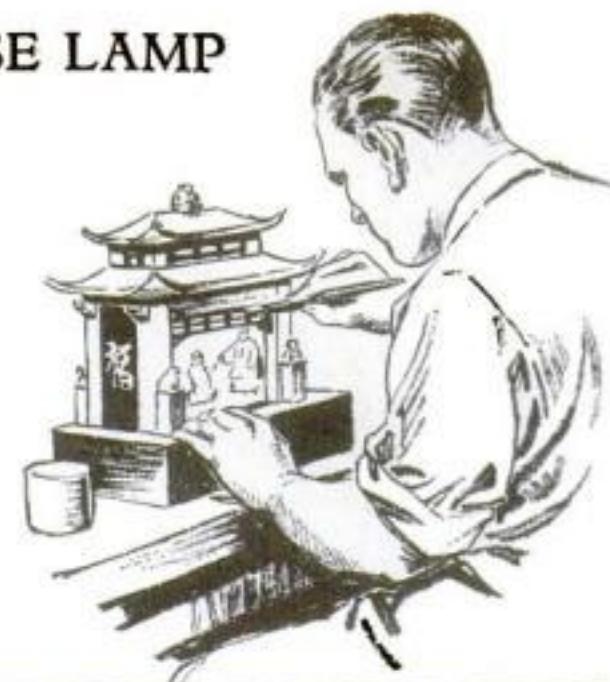
How the pylon is made. The wind sock must be placed so it points out over the airplane

### SAWED-OUT CHINESE LAMP



Two translucent Chinese pictures mounted on glass form the chief decorations of this novel lamp

The light shines through the pictures as well as through the grill work above them and out between the roofs



MADE almost entirely on a power jig saw, this oriental lamp stands 10 1/2 in. high over all and has a base 5 1/2 by 9 in. The base contains a 110-volt candelabra lamp. The light shines through translucent Chinese pictures mounted on glass in the openings, front and back, as well as through the grill work just over the pictures and through the open grill work between the two roofs. The upper grill acts as a ventilator for the lamp.

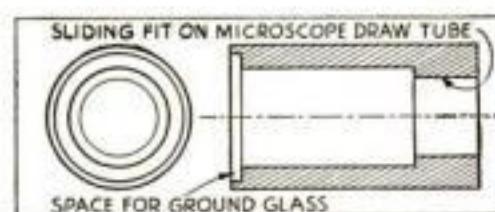
I have designed and made many of these lamps, no two exactly alike, and they have proved extremely popular with my friends. Almost any arch design can be used, although I find the Chinese more ornate and diversified. All my lamps are made of three-ply wood 1/4 and 3/16 in. thick, except the roofs, which are cut from 1-in. cedar.

The roofs are cut out roughly with a hand scroll saw to give the curled effect at the corners. The undersides are smoothed with a sanding disk and the upper sides with a sanding drum. The grill work is cut from cigar-box wood. The lamp and electrical fixtures in the box which forms the base can be readily reached by the removal of the bottom board. The removal of two screws inside the base releases the upper portion of the lamp so that the glasses containing the pictures can be easily slid out, if desired.

These lamps make effective night lights, or they can be used purely for decorative purposes. They are lacquered in gay colors. The stone dogs and the bronze Buddha used on the particular lamp illustrated, were imported, as were the pictures.—HUGH MULLIKIN.

### SMALL PROJECTOR FOR MICROSCOPE

MOST amateur microscopists would like to own a microprojector so that they could show the enlarged images to more than one person at the same time. The



This simply made microprojector enables an enlarged image to be drawn accurately on the ground-glass disk

instrument illustrated is merely a cylinder of wood about 3 in. long that fits snugly on the drawtube of the microscope, with space at the outer end for a circle of ground glass about 1 1/2 in. in diameter. Ground glass can be made by taking two pieces of ordinary glass, placing some fine valve-grinding compound between them, and rubbing them together.

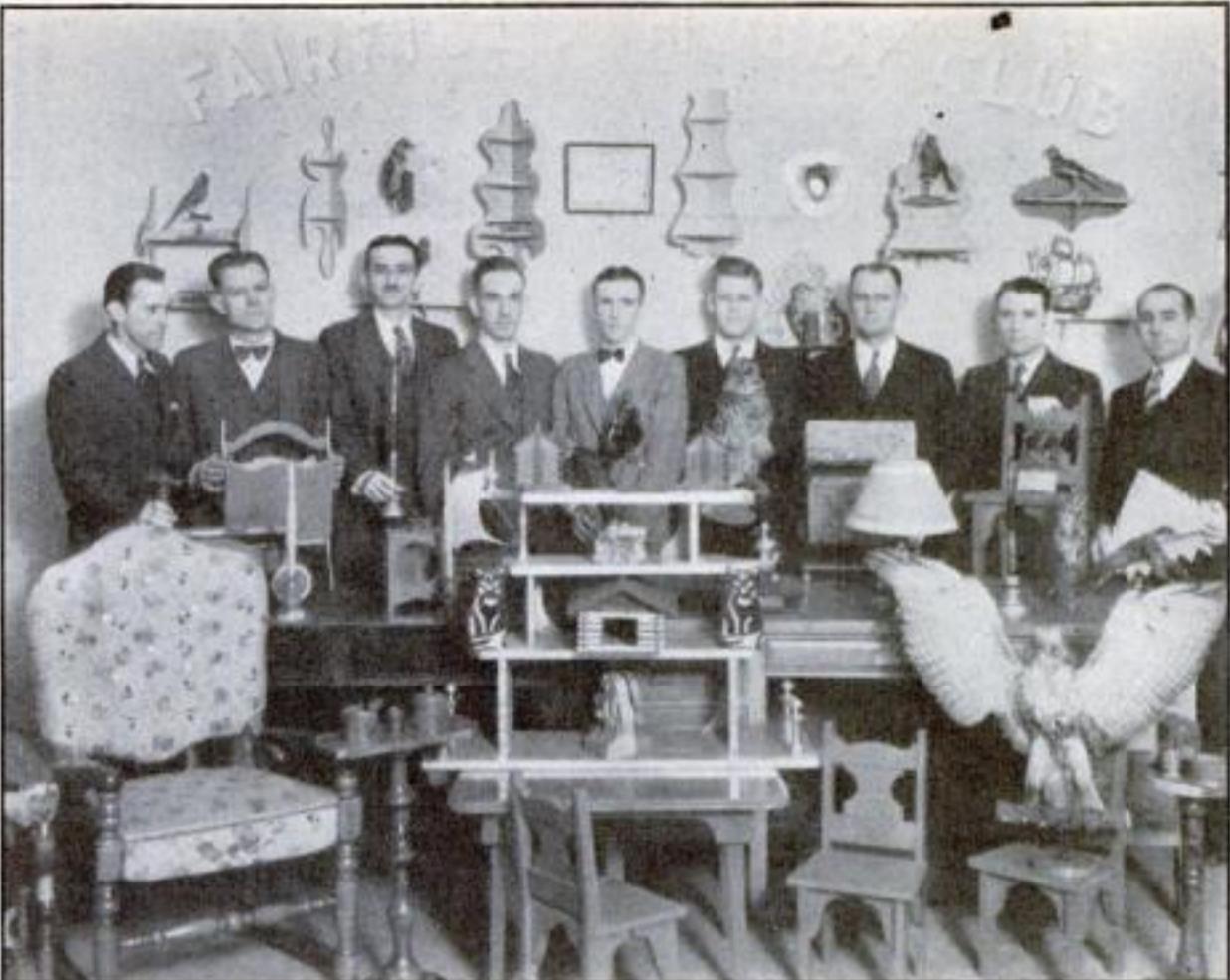
By turning the glass so that the ground side is uppermost, the enlarged image can be drawn directly on the ground surface with a pencil. The glass can then be removed, and the drawing traced.—C. G. GROVER.

Amazing  
Variety of Projects  
Made by Members  
More Clubs Organized  
Complete Official  
News of the  
NATIONAL  
HOMWORKSHOP  
GUILD

By  
E. RAYMOND DELONG  
*National Secretary*



Official Magazine  
POPULAR SCIENCE  
MONTHLY



Members of the Fairfield Hobby Club of Fairfield, Ala., with a group of the varied projects displayed at their handicraft show. The club staged the exhibit when only a few weeks old.

## HOME WORKSHOP CLUBS Display Skill in Many Exhibitions



Four members of the Dixon Homeworkshop Club of Dixon, Ill., examining articles entered in their show

YOUNG as is the National Homeworkshop Guild, a number of its eighty-two affiliated clubs have already held successful exhibitions of craftwork. Practically all the larger clubs that have not yet done so are planning to give exhibits of their work next fall or winter.

Since the main purpose of the Guild is to promote good-fellowship among amateur craftsmen and to give them an opportunity to see the work of other men with similar hobbies, the staging of an annual exhibition is one of the most important, interesting, and educational features of every club program. It serves as a summary of the year's work. It gives the club members, their friends, and everyone in the community who appreciates

fine handmade articles an opportunity to see just what the other fellow has accomplished. There can be no greater incentive to individual effort and nothing that will bind the club members together more successfully in friendly coöperation and competition.

Suggestions for holding exhibitions were contained in the Guild's monthly bulletin No. 4, which has been sent to the secretaries of all affiliated clubs. The information was based

largely on the experience of the parent club in Rockford, Ill., which has had a total attendance of about 8,000 at its two annual exhibitions. A sample entry form and hints on publicity, photographs, and other matters pertaining to the practical planning of exhibitions were given. If, however, questions arise which are not covered in that bulletin, they may be referred by club secretaries directly to Guild headquarters in Rockford.

The larger clubs, of course, require no encouragement to hold exhibitions, but some of the smaller clubs may hesitate because the members think that they cannot muster sufficient projects to make a worth-while showing. That is a mistake. No matter how small a club may be, it should designate one meeting night a year for a general exhibition of its work and hold open house for the family and friends of the members. The experience of the Guild officers is that the number and quality of the exhibits will be better than any member of the club expects and that the interest and enthusiasm displayed by the visitors will greatly encourage the club. The local newspapers will be glad to coöperate by giving the exhibition publicity; and the club will not only gain in prestige in the com-

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# ORIGINAL Place Cards MADE ON Jig Saw

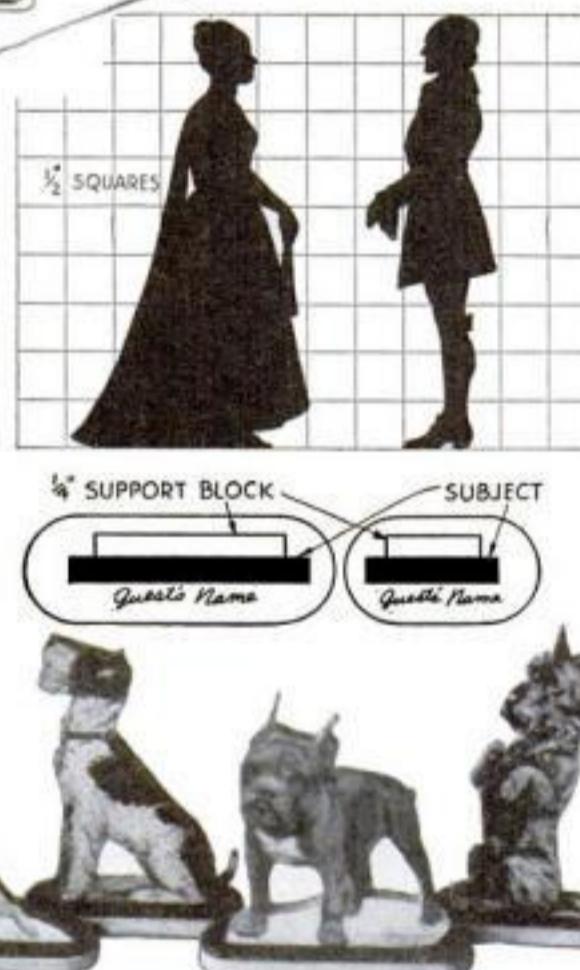


No guest can fail to feel complimented if he finds an original handmade place card at his plate. The figures may be silhouettes or colored pictures from magazines

**F**Ollowing closely in the wake of jig-saw puzzles are place cards like those illustrated. They will help keep jig-saw enthusiasts busy.

The silhouetted figures are outlined on  $\frac{1}{4}$ -in. smooth surfaced basswood. The base is made from the same material, and a block  $\frac{1}{4}$  in. square and as long as necessary is glued to the surface of the base as shown. The silhouette is glued to the base in an upright position and painted a dead black to carry out the conventional silhouette idea. Colors, however, could be used if preferred. Enough of the place cards are made in this way to take care of all expected guests. The names are written or printed by hand on the base block in front of the silhouette.

Another novel way of making the place cards is to cut pictures of dogs, horses, and other animals from magazines and glue them to  $\frac{1}{4}$ -in. basswood. Pictures may be chosen, if desired, to correspond to the guests' hobbies. Mount them as at the right.—J. S. BEACH.



Animal pictures make attractive place cards. They are mounted on basswood, jig-sawed out, and mounted on a base like the silhouettes

## PLATING WITH OLD HYPO

OLD photographic hypo solution (fixing bath) can be used to give a silvery finish to articles of brass, copper, and other metals if they are of a decorative nature and not subjected to much wear or handling. The process consists of immersing the well-cleaned article in the hypo solution and moving it about for one or two minutes. Then remove, wash a few seconds in clean water, and dry with a cloth. If a heavier coating is desired, repeat the operations.—VERNON B. CASE.



Used hypo gives silvery finish to metal

## OUTDOOR ROASTER

FOR picknicking in the garden, many persons would prefer to roast their frankfurters or meat outdoors over charcoal embers, yet do not care to construct a permanent fireplace. They will find that the type of roaster illustrated at the right takes up very little room and can be easily handled. It may be placed at different angles according to the wind, and can be carried to the cellar or set in an out-of-the-way place when not in use.

The roaster can be made from galvanized iron, with the exception of the grate, which should be woven corrugated iron or strips of heavy wire. The framework is put together with stove bolts to enable it to be taken apart for carrying in a car on picnic trips. A few holes in the trays will allow the water used in extinguishing the fire to drip out without the necessity of turning the roaster upside down.—H. B.

## KITCHEN CHAIR COVERED FOR BEDROOM USE

THE popularity of breakfast sets has caused many kitchen chairs to be relegated to the attic or storeroom. These can be made into attractive bedroom chairs by covering them with cretonne, chintz, sateen, or materials to match the coverings used in the room. The seat, which is usually a solid board, can be padded with cotton felt and the cover drawn over it. The cover should be tacked as low as possible to the sides so the tacks will be concealed by the skirt.

The back is covered with burlap, which is tacked to each spindle or rung. This will leave the hollow effect in the back. As the number of spindles vary from three to five in the back of this type of chair, no actual sizes can be given for cutting the cover. Each section of the covering should be cut or marked  $1\frac{1}{2}$  in. larger than each section between the rungs in the back, and should be tacked on the underside of the covering to each rung. Do the center section first, then work toward the outer ends. Tack a piece of covering to the rear back, low enough so the tacks will be covered by the skirt.

The skirt can either be box-pleated or Shirred all around and should be short enough so as not to touch the floor. It may be tacked on with brass-colored metalline nails, or the color of the nails can be such as to blend or contrast with the color of the covering materials which have been used.—HERBERT BAST.



Chair with covering partly removed to explain the method. Right: How it appears when finished

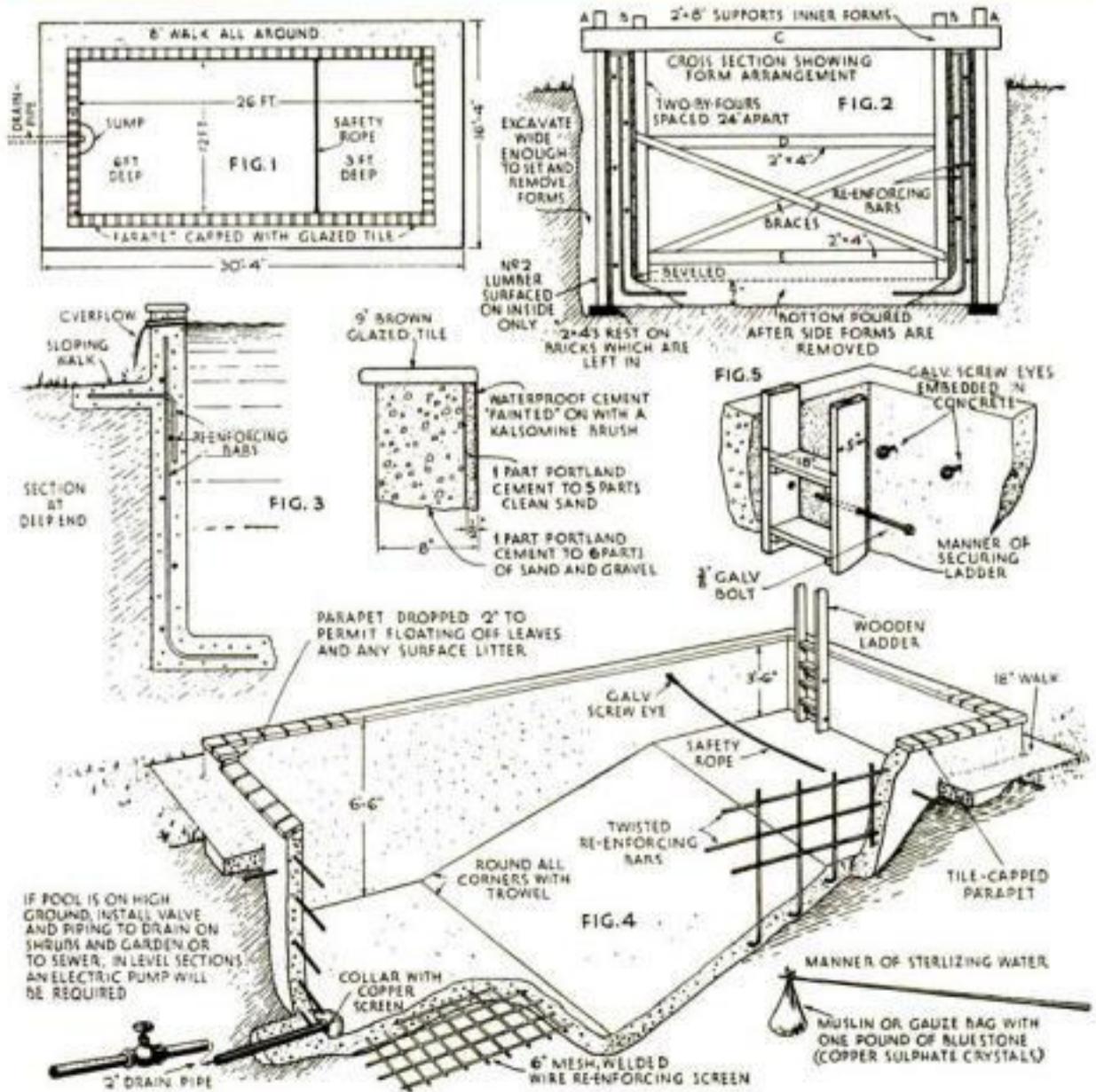


This portable garden roaster can be taken apart for carrying on picnics

# FAMILY Swimming Pool

BUILT IN BACK YARD

By *Hi Sibley*



One does not need to be rich to enjoy a private swimming pool. The materials for a small pool can be obtained for less than \$100

As many as eleven bathers have used this pool at once, although it is only 12 by 26 ft. Children can dive in it

**T**HIS small private swimming pool is designed for the modest pocketbook in respect to the original cost as well as the expense of upkeep. While it is large enough for a dozen children or four or five adults to enjoy themselves thoroughly, the dimensions (Fig. 1) are limited to reduce the cost of material and labor and, subsequently, to keep the water bill within reasonable limits. With an experienced helper or a strong boy, any man should be able to do the job in his spare time. It is certainly worth all the trouble and nominal expense to have a private pool through the hot weather.

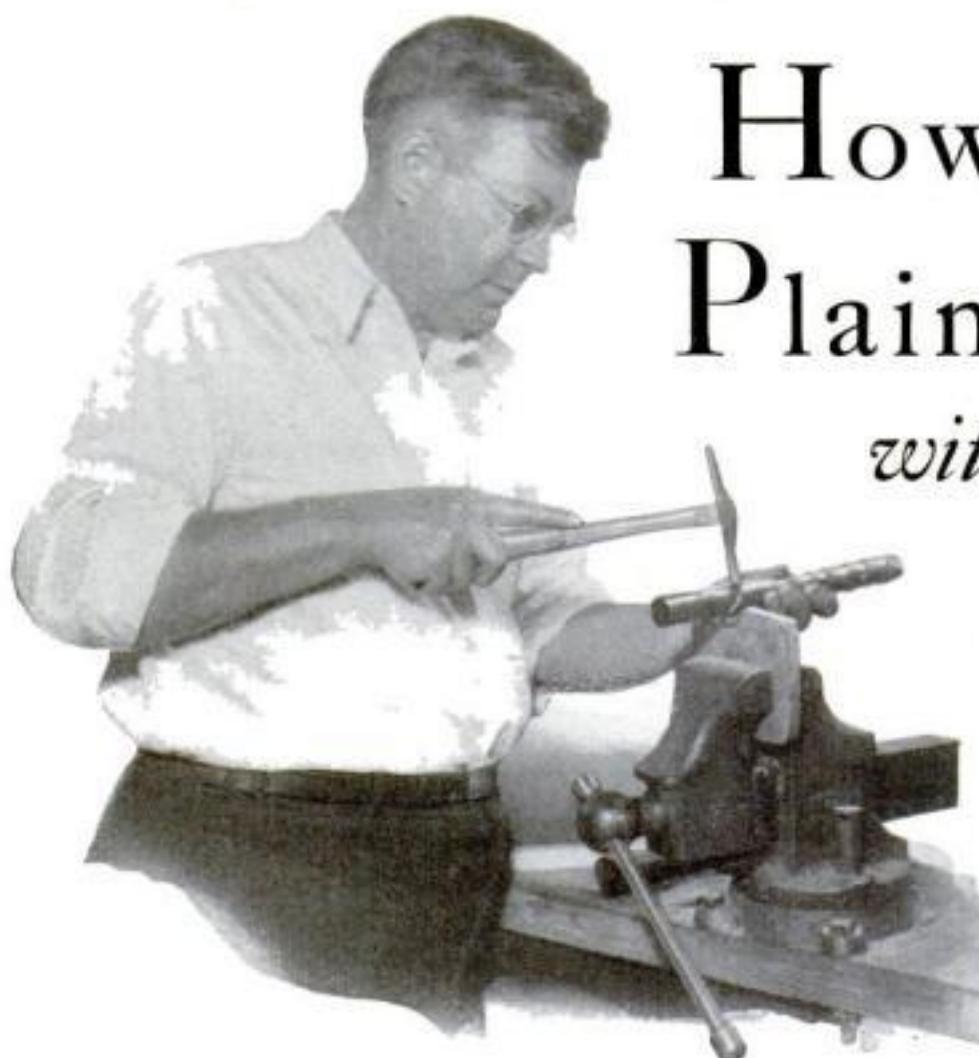
The depth can be made to meet individual requirements, but bear in mind the deeper it is, the more labor in excavation and the more materials required. An adult can swim comfortably in 5 ft. of water, but cannot, of course, risk a high dive at that depth.

The pool could be made smaller than shown, say 12 by 22 ft., and 6 ft. deep at one end and 3 ft. at the other. The walls are shown as 8 in. thick, but 6 in. would be amply strong if reinforced. A pool of this size would require about 11 cu. yd. of concrete, including about 54 bags of cement. Concrete can be bought ready mixed in many localities. It is delivered in tank trucks to be poured at once. The price in Pasadena, Calif., where the author lives, is \$6.35 a cubic yard. The only other expense would be the drainpipe, re-enforcing material, and lumber for the forms, provided the owner did all the work. The estimate for cement does not, however, include the walk around the pool.

A junk yard will usually yield enough old rods, bars, and pipe to serve as re-enforcing material, and the lumber for forms can be purchased cheaply from a wrecking yard. It is therefore quite possible to build a pool for less than \$100. The one illustrated in the photographs was built entirely with hired labor and, being in a section of the country subject to earthquakes, was made more substantial than necessary elsewhere, yet its cost was only \$275 complete.

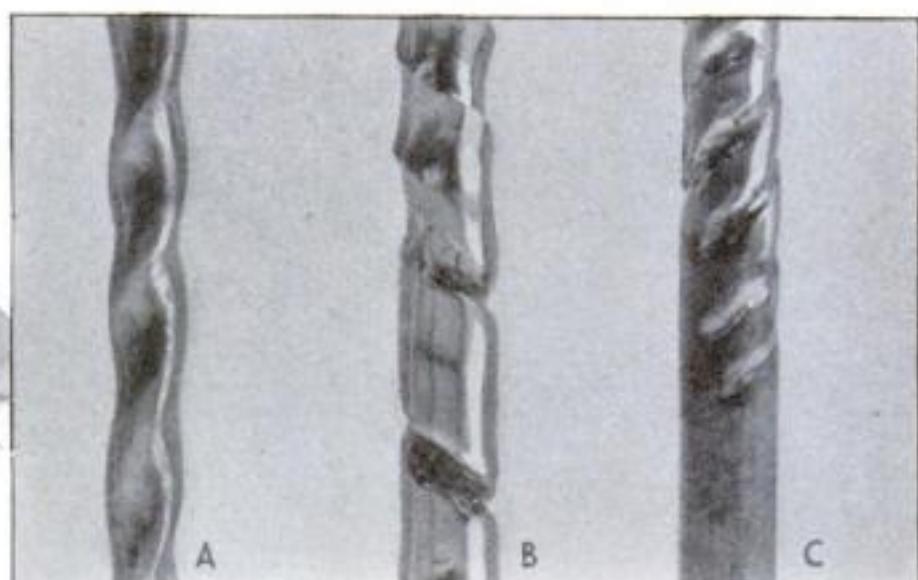
*(Continued on page 89)*

J. S. HAGANS, *an authority on craftwork, tells*



The first stage in making the sample marked *B* at the right. Mr. Hagans extends his forefinger along the hammer handle to give accurate control

# How to Ornament Plain Metal Tubing with Graceful Spirals

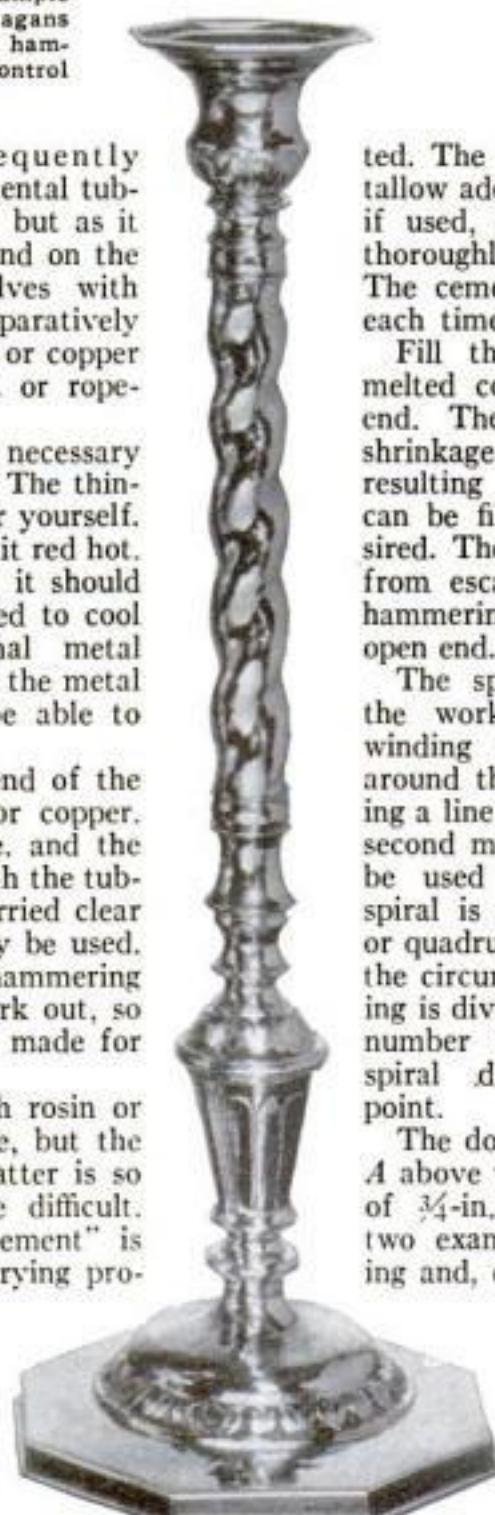


**H**OME CRAFTERS frequently need a piece of ornamental tubing for some purpose, but as it cannot usually be found on the market, they content themselves with plain tubing. It is, however, comparatively easy to decorate ordinary brass or copper tubing with a variety of spiral or rope-twist effects.

So, without more ado, get the necessary plain tubing of the desired size. The thinner the tubing, the less work for yourself. Anneal it thoroughly by heating it red hot. Authorities differ as to whether it should be quenched in water or allowed to cool spontaneously. The professional metal worker says that the first leaves the metal softer, but the amateur will be able to detect no difference at all.

It is desirable to close one end of the tubing with a piece of brass or copper. This is silver soldered in place, and the edges are dressed down flush with the tubing. The fluting then can be carried clear out to the end. Soft solder may be used, but it will loosen under the hammering and the filling material will work out, so some allowance will have to be made for waste.

The tubing can be filled with rosin or lead if nothing else is available, but the former is too brittle and the latter is so hard it makes the work more difficult. What is known as "chaser's cement" is better; this is made up of varying proportions of rosin, plaster of Paris, tallow, and shoemaker's wax. A typical mixture is .5 lb. rosin,  $\frac{1}{2}$  lb. mutton tallow, 2 lb. plaster of Paris, and 1 lb. shoemaker's wax. The latter is frequently omitted.



A candlestick with handmade spiral. The pitch or angle of the spiral and its depth may be modified as desired to suit the object

ted. The rosin is melted, the tallow added, and the plaster, if used, is sprinkled in and thoroughly mixed by stirring. The cement must be melted each time it is to be used.

Fill the tubing with the melted compound up to the end. There is considerable shrinkage in cooling, and the resulting cavity or "pipe" can be filled later on if desired. The pitch is prevented from escaping too easily by hammering the metal over the open end.

The spiral is laid out on the work free-hand or by winding a strip of paper around the tubing and scribing a line along the edge. The second method, however, can be used only if a double spiral is desired. If a triple or quadruple spiral is wanted, the circumference of the tubing is divided into the desired number and an individual spiral drafted from each point.

The double spiral shown at *A* above was made in a piece of  $\frac{3}{4}$ -in. tubing. The other two examples are 1-in. tubing and, even with this fairly

large diameter, the three-spiral shown at *C* shows how much closer the spirals come together when more than two are used.

One illustration shows how the work is done on a lead block. If a sufficiently large block were used, the vise could be dispensed with. This photograph shows the initial stages by which the concave spiral in example *B* is arrived at. A raising hammer is used for scoring the tubing rather deeply; then the spaces between are hammered down with a ball-head form of planishing hammer. By reversing the work as you go along, the edges of the helixes can be sharpened up as cleanly as desired.

The initial stage in developing all three examples is to score along the spiral layout. It will be noted that *B* is produced by driving the metal down between the scored spirals, whereas in *A* and *C* the scored line serves as a starting point for rounding off the raised portions between to give each the effect of a strand in a piece of cordage. In order to do this, a raising hammer like that shown may be used, but one with a somewhat wider head and more on the order of a planishing hammer is better. In fact, a more or less flat, rectangular planishing hammer is the preferred tool; and the wider the face, the smoother the work will be.

The spirals can be raised or depressed almost as deeply as one desires, but for any unusual depth it will be advisable to melt out the pitch when the work has progressed about halfway, anneal the metal again, and then refill with pitch.

When the work has been finished, it is warmed, and the filling compound is run out into its container for future use. Melt it at a gentle temperature.



Fig. 1. "Look! He's stuck the knife right through his arm!" It's a trick that children watch with amazement

**P**LUNGING a wicked-looking carving knife through your arm, cutting a playing card in half and yet not injuring it, and making a deep gash in your finger are some of the trick "surgery" stunts you can do with these magic knives. They are not as dangerous as they look, but spectators should be cautioned against raiding the kitchen cutlery department and attempting to duplicate your tricks.

The knives are bought in a department store and doctored with a file, soldering iron, and several scraps of heavy tin. You should do some practicing beforehand in front of a mirror and learn to switch unprepared knives for the trick ones without detection. This is very easy to do, for your spectators will be so startled and dazed it will be easy to distract their attention.

To all appearances the carving knife shown in Figs. 1 and 2 passes entirely through the arm, and the effect is height-

# MAGIC KNIVES

## for Trick Surgery

BY  
GEORGE  
S.  
GREENE



Fig. 2. The knife can be twisted from side to side

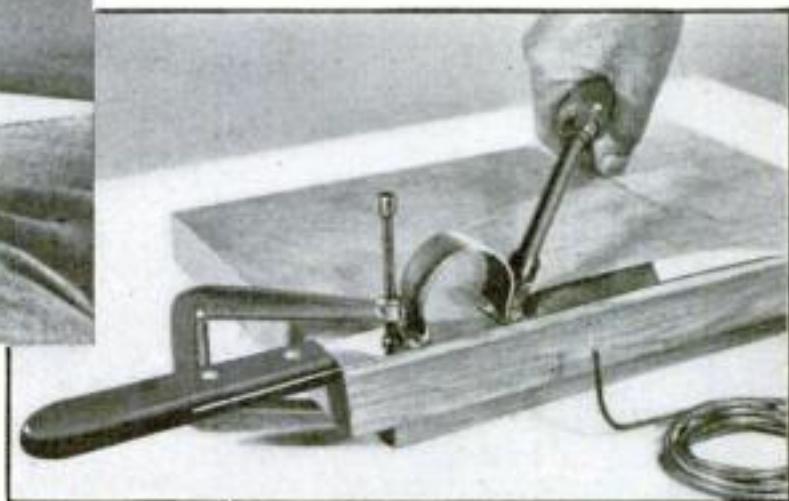


Fig. 3 (at right). Soldering on the U-shaped arm clamp

ened by twisting it from side to side. You can turn your back when adjusting it on the pretense that the sight might give some spectators heart failure. The knife is tricked by removing a 2-in. section and soldering a U-shaped piece of spring metal in the breach, as in Fig. 3. The breach should be covered with the fingers when exhibiting the knife beforehand, and the spring piece may be painted flesh color.

"Oh how it hurts!"—

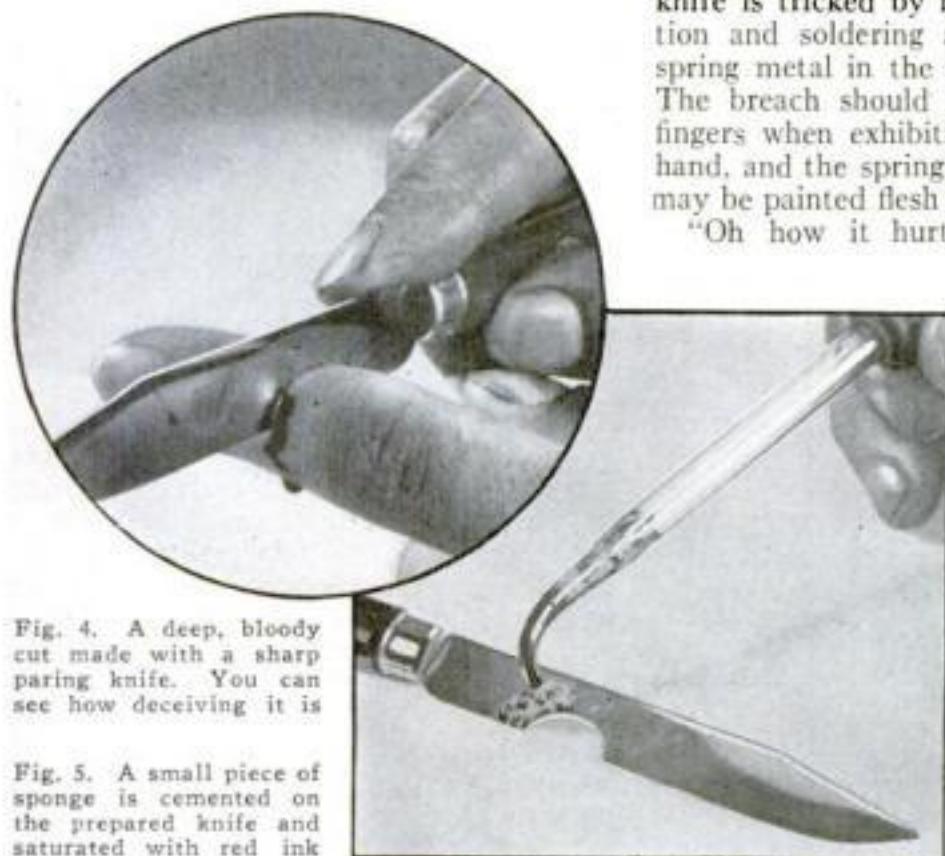


Fig. 4. A deep, bloody cut made with a sharp paring knife. You can see how deceiving it is

Fig. 5. A small piece of sponge is cemented on the prepared knife and saturated with red ink



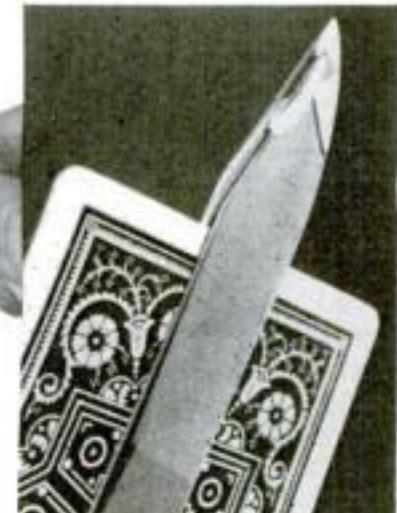
Fig. 6. The king is beheaded with the knife, yet the card is immediately shown to be wholly unharmed. At right: The knife has two tips

apparently—to cut your finger as in Fig. 4. Have a duplicate paring knife (they cost ten cents) ready for exchange. The prepared knife has a half-circle space filed out of the cutting edge, as in Fig. 5, and a bit of sponge is soaked with red ink after cementing it to the side that will not be seen. The ink will readily stream from the knife. Be sure to daub some on the duplicate.

The king of clubs is beheaded and the card apparently cut in two in the entirely deceiving trick illustrated in Fig. 6. Hand the card out for examination, and while the audience is wondering how it happens to be whole you can slip off the knife tip. The right-hand photograph of Fig. 6 shows how the knife looks from the rear. A fake 2-in. tip, removed from another and similar knife, slips over the

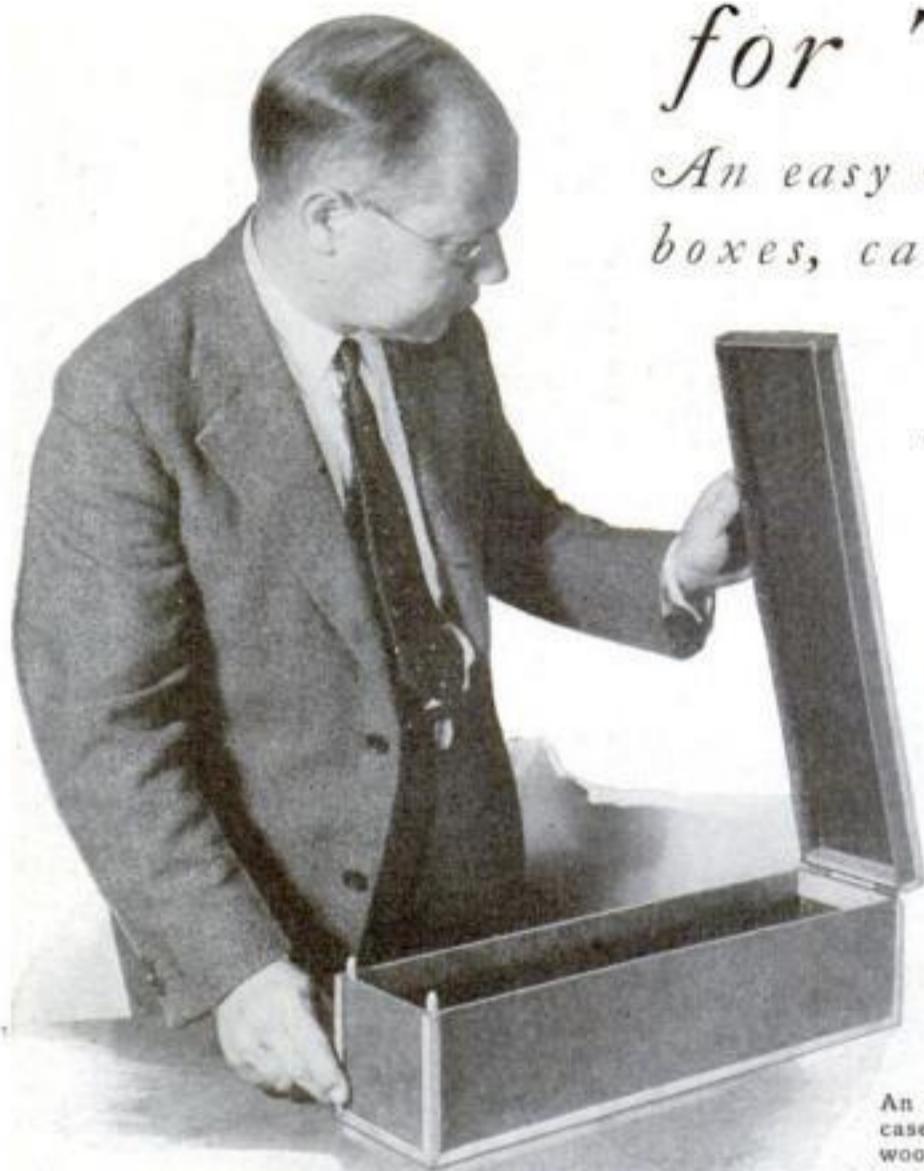
point of the original and is held in place by means of a small piece of tin soldered to the tip. The corners of the tin are bent over, and the tip can be quickly slipped off into the palm of the hand. The illusion is perfect.

Practice these tricks so thoroughly that you can do them automatically while keeping up a stream of amusing and mystifying patter. You have a great advantage over the members of your audience, who do not know what you are going to do, much less how you are going to do it.

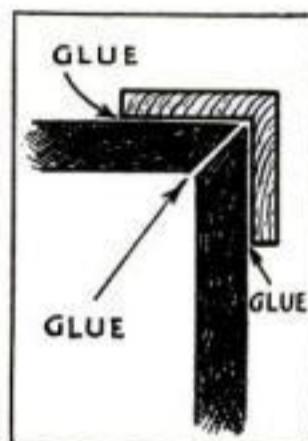


# Strong Corner Joints for THIN STOCK

*An easy way to make light, neat-looking boxes, cabinets, and instrument cases*



By  
Thomas W.  
Arnold



An unusually strong, light case made of thin pressed wood composition. The joints are formed as in the diagram

THE amateur woodworker soon finds that corner joints of the tongue-and-groove, dado, or rabbet types are exceedingly difficult if attempted with thin stock. Furthermore, the remarkably strong and warpless panels made of pressed wood fiber, which are now used for so many purposes, are not adapted for such joints. The joint illustrated is better when thin wood, plywood, or pressed fiber panels are to be used in making boxes.

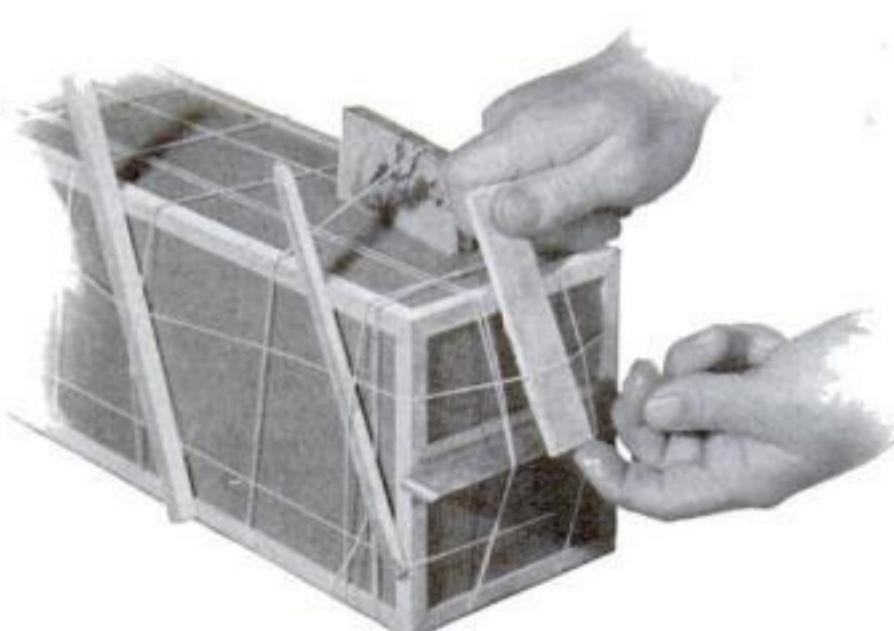
All cutting is done with a circular saw, no dado head is required, and no clamps are needed in the gluing operation. The L-shaped locking strip is only  $\frac{1}{8}$  in. on each leg, and the legs are only  $\frac{3}{32}$  in. thick. The panels are of  $\frac{1}{8}$ -in. pressed wood fiber. When pressure is applied to a joint like this, the edges of the panel are forced together and the outer edge surfaces of the panels are forced against the inner surfaces of the locking strip.

Making the locking strips is most easily done by ripping the wood into squares and then setting the saw and rip guide so that passing the piece through twice will re-

move the core to give the L-form. Incidentally, the portion removed is a perfect square and can be saved for model making or other purposes.

The edges of all panels are cut to a 45-deg. bevel. The squared-up dimensions of the panels before the beveling operation will be exactly the same as the finished outside dimensions of the box, which, of course, will be the inside dimension plus twice the thickness of the panel material.

Only three settings of the saw and rip guide are needed to bevel all panel edges. The guide should be set so that the saw barely clears the edge forming the point

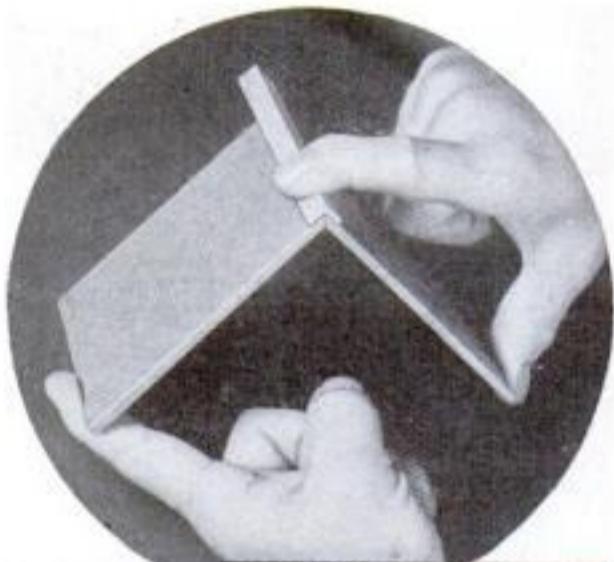


It is sufficient to tie the assembled box together with strings and then insert wedges to increase the pressure

of the angle; then this line will form a guide when the panel is turned around to cut the opposite edge. All beveling is on the same side of each panel.

Twelve lengths of locking strip have to be cut, four for each of three different dimensions. Their lengths will be equal to the outside dimensions of the box or cabinet plus twice the thickness of one leg of the locking strip. The ends of the locking strips are cut to 45 deg. on each leg of both ends with the aid of the cross cut guide set for this angle. The cuts should be taken so that the saw just barely clears the end which is thus formed.

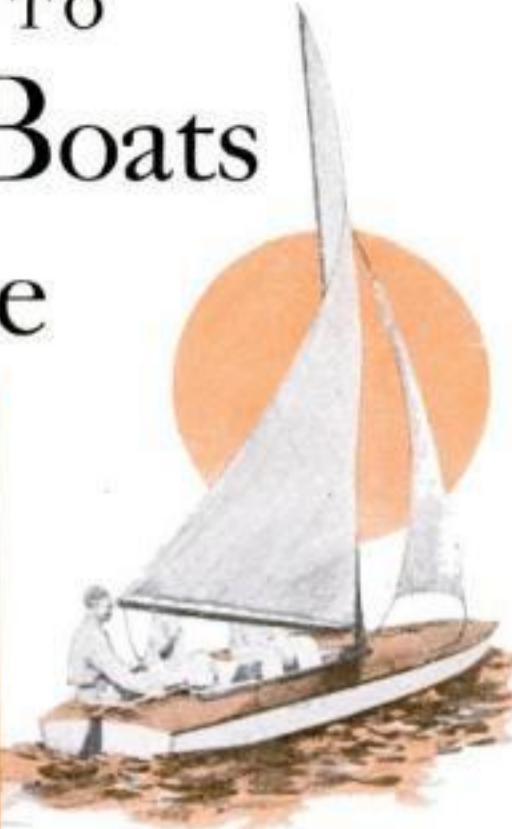
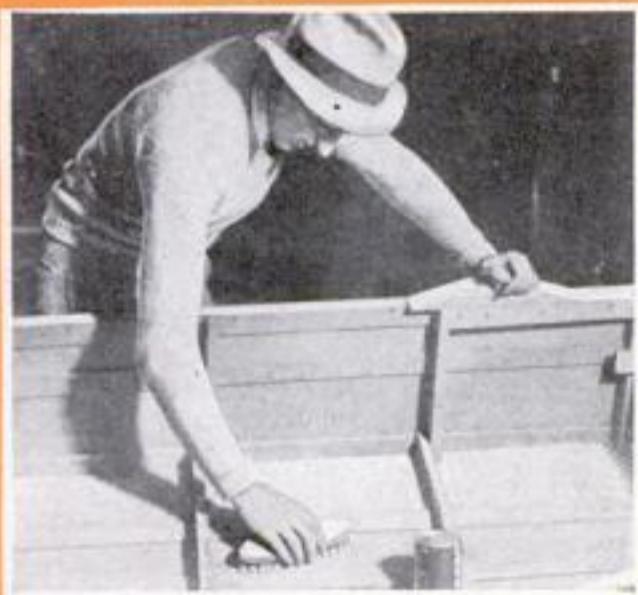
To assemble a box constructed in this



way is easy if you first lay out four pieces of string across the bench tit-tat-to fashion. Then lay the locking strips for one side on these strings with tacks behind them to hold them into rectangular contact. Apply glue to the strips and to the edges of the panel and drop it into place. Next, after gluing, set the other panels on edge to form a square resting on the first panel as a base. The tackiness of the glue will hold their edges together long enough to allow you to apply the remaining side panel and the corresponding four locking strips. Now bring the ends of the four strings up over the top and tie.

From there on it is merely a matter of applying the four remaining locking strips, tying with string and wedging the strings tight. The lid is sawed off afterwards.

# HINTS ON HOW TO Keep Small Boats Shipshape



The first step in getting a boat ready for the season is to remove all the small fittings and equipment and scrub the hull, inside and out, with hot water and a cleanser

*Timely repairs and repainting will insure better sport this summer*

BY WILLIAM JACKSON

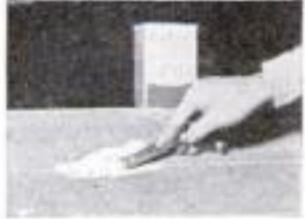
**B**EFORE the boating activities of the new season get under way, you should take sufficient time to renovate your old craft. Even if it is a last year's acquisition and in generally first-rate condition, a little work on it will be well repaid. Indeed, part of the fun of boat ownership lies in doing the little jobs that insure long and trouble-free service.

The following methods apply to craft that are still in fairly good condition, but even some very old boats may be restored sufficiently for limited service.

Upon removing and laying aside for future cleaning and polishing any fittings or equipment such as lights, blocks, ropes, cleats, and cushions, the first step, be it sailboat, motor-boat, hydro, or canoe, is a thorough cleaning inside and out preparatory to painting.

The floor boards and, if possible, the engines of inboards are removed. The entire interior of the hull, especially where bilge water accumulates, is thoroughly scrubbed with a stiff brush, accompanied with liberal applications of hot water and strong cleansing powder. Remove all accumulations of grease, dirt, and sediment, and flood out the residue with clean water. The outside and decks are now cleaned in similar fashion. The result is likely to be a revelation, as much of the painting thought necessary may be dispensed with.

After cleaning the hull, allow it to dry thoroughly inside and out. Examine the inside for dry rot. Jab a penknife into the places where rot is likely to be found, such as stem, transom, and keel—places mostly below the water line. If rotted or soft areas are found, carefully dig out the bad portion. If the holes are small, fill them with a plastic wood composition or crack filler. Large



All cracks are filled with seam compound or white lead putty

sistency of putty. Before applying this crack filler, coat the surface with casein glue and allow to dry.

Refasten all loose nails, screws, and bolts. Loose bolt holes should be filled with crack filler. Rebore to the required size and refasten.

Examine the sides and bottom for split plank ends, chafed spots, dents, and gouges just as you did the transom, keel, and stem for dry rot. Remove the paint from all damaged areas to insure the adhesion of the filler. Then apply crack filler until the filler projects slightly above surface. When dry, plane and sand smooth.

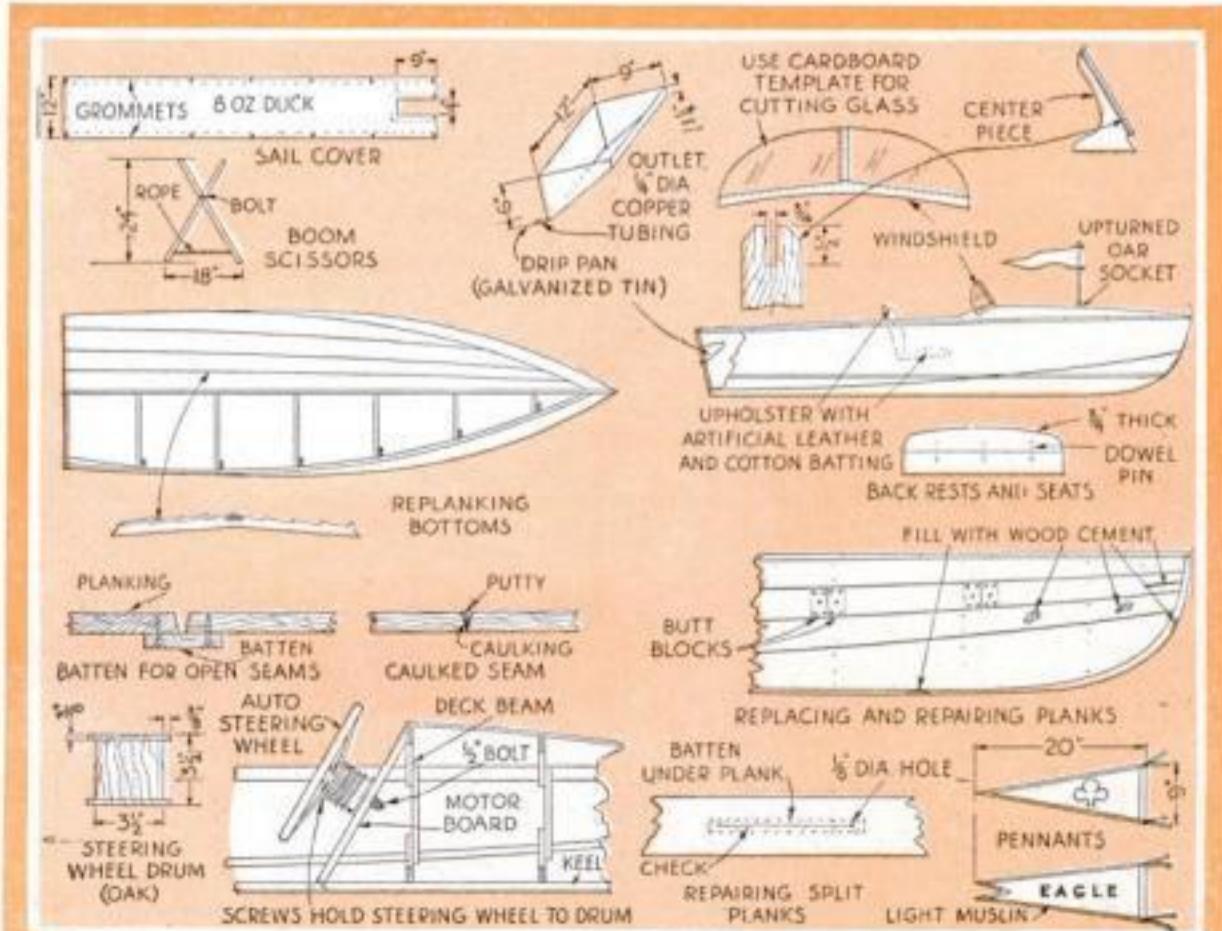
To make a permanent and invisible repair of checked or split planks, bore  $\frac{1}{8}$ -in. diameter holes at each end of the fracture, coat with glue, and insert wood plugs. A batten  $\frac{1}{4}$  by  $1\frac{1}{2}$  in. and 3 in. longer than the check is coated with casein glue and placed so as to cover the check equally on all sides. Fasten it with screws or nails to the underside of the plank. Fill the crack with plastic wood composition or crack filler, and sand smooth.

If a damaged or rotted plank requires replacement, saw the plank square at each side of the damaged area, and remove only as much as is necessary. Smear butt blocks with glue and insert the blocks behind the plank edges so that they cover the joint equally, as shown in one of the drawings. Securely fasten the plank edges to the butt blocks with screws.

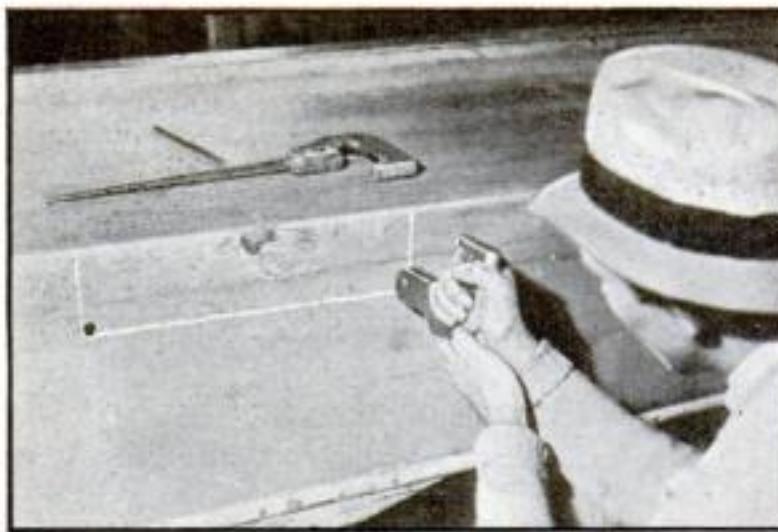
Hulls with caulked seams should be examined and recaulked only if necessary. Caulking in bad condition should be removed. An old file with the tang bent over is a good tool for this purpose. If caulking is removed, paint the seam and recaulk with cotton



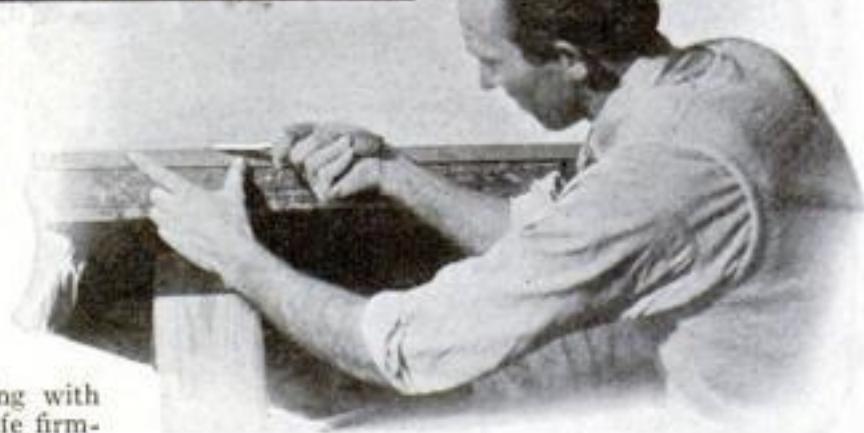
Caulking in bad condition must be removed and cotton wicking tamped firmly in the seam



Methods of replanking bottoms, replacing and repairing planks, fixing splits and checks, and making accessories such as sail covers, drip pans, seats, windshields, and steering wheels



Above: Sawing out a bad spot. The plank is then repaired as indicated in the drawings on the opening page of this article. Right: Scribing the upper mark of the water line



wicking. Tamp the wicking with a caulking iron or putty knife firmly but not too tightly in the seam.  $\frac{1}{8}$  in. below the surface. Paint the caulked seam. When fairly dry, fill the seam with a commercial seam compound or a mixture of one part whiting and two parts white lead.

Open seams should be covered with battens to prevent the caulking from being pushed through, as shown in one of the drawings.

Hulls of the batten seam type are scraped and sanded smooth on the sides and bottom. Fill the seams flush with a commercial seam compound or the whiting and white lead combination. Varnished decks and sides are sanded smooth, and the seams are filled with seam compound to which ground colors may be added to match the wood.

Canvas decks are sanded smooth and painted. If any canvas surfaces are chipped or badly cracked, they should have the paint removed with liquid remover. Wash off the residue with gasoline and refinish with three coats of deck paint. Rotted or torn canvas decking should be replaced with 6- or 8-oz. duck. Before doing this, remove all traces of paint from the deck. Apply a thin coat of casein glue to the decking, stretch the canvas in place, and tack securely. Rub the entire surface with a pad to insure complete adhesion. Allow four hours for drying, and apply a thin coat of casein glue to the outside of the canvas. When dry, sand this smooth and apply three coats of paint. Sand lightly between coats. This makes a smooth and absolutely watertight job.

Hulls of duck boats, hydros, rowboats, or lightly constructed craft with checked or split planking and boats with leaky bottoms but otherwise in good condition may be made stronger and permanently watertight and restored for many years of service by applying canvas. Canoes may also have new canvas applied.

To prepare the bottom or surface, refasten any loose nails, screws, or bolts. Completely remove the paint from the surface with liquid remover or a gasoline blowtorch. Then examine the bottom for open seams, dents and chafed areas, and fill with crack filler. Smooth the entire surface with plane and sandpaper to remove high spots. See that the finished surface is smooth and even.

Obtain enough 6- or 8-ounce canvas ducking to cover the bottom and project slightly above the gunwale. Cut the canvas roughly to size and apply a thin coat of casein glue to the underside of the canvas and the surface of the planking. When dry, apply a thick coat of casein glue to the hull, stretch the

canvas over it, bringing the edges to the top of the gunwale, and tack the edges securely.

If wide canvas is not obtainable, use two widths with the seam along the center of the keel. Glue and tack well. Cover the edge with  $1\frac{1}{2}$  in. wide cloth tape. Cover the row of tacks at the gunwale with a  $\frac{3}{4}$ -in. half-round molding. Rub the entire canvas surface with a pad to insure complete adhesion. Apply a heavy coat of casein glue to the canvas and allow to dry. Sand smooth and apply three coats of gloss paint, sanding lightly between coats.

For canoes, instead of coating the new canvas with glue, apply thick paste wood filler, rubbing it in well. When dry, sand the surface smooth and apply three coats of gloss paint followed by two coats of varnish.

For an excellent varnish or paint finish, observe the following simple points: Fill all seams with compound, and all cracks and abrasions with filler. Sand all painted and varnished surfaces. For varnish that is still in good condition, rub with steel wool to remove the luster. Wipe the surface free of dust and dirt. Choose dry, fairly warm, and well-ventilated surroundings.

WHERE the present finish is dull but still in fairly good condition, sand and apply one or two coats of good gloss paint or enamel. For a brilliant finish, follow with two coats of spar varnish. Enamel presents a gleaming finish for topsides and bottoms. Thin the first coat with turpentine. For better service, use copper or special composite bottom paints on the bottom.

A sharply delineated water line gives a neat appearance. Every used hull will have a water mark left by immersion. Using a straight batten, scribe a line with a sharp knife about 2 in. above the true water line from stem to stern. Below and even with the scribed line, apply the bottom finish. Paint the topsides a contrasting color.

All fittings should be cleaned, polished, or replated when necessary, and replaced. Examine ropes for broken strands and frayed spots. Give anchors and chains a coat of aluminum paint.

Frayed or torn canvas spots on canoes should have a coat of casein glue applied to the underside of the tear and on the thin planking. Press the edges down firmly. If the edges are separated, press a plastic wood composition or crack filler into the fracture and sand smooth. Cut a piece of silk of the required size, apply a coat of shellac to the silk patch, and lay the patch on the surface, smoothing out all air bubbles. When dry, sand lightly and varnish or paint.

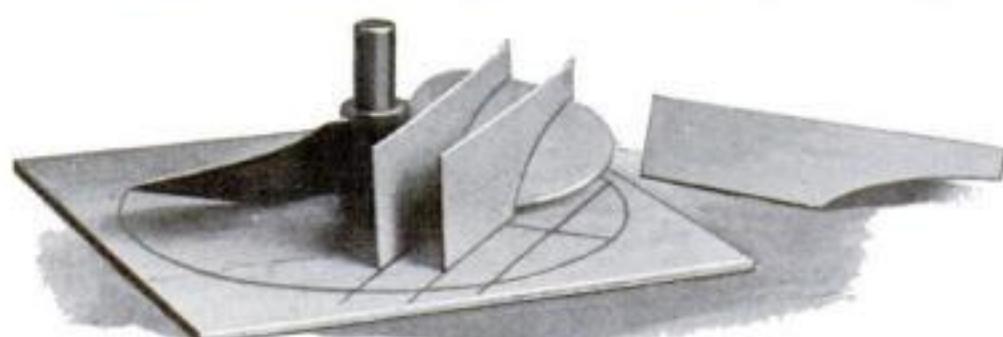
IF YOU own a sailboat, wash the sails and dry well. Examine and repair frayed areas and rents. Worn halyards and ropes with broken strands should be replaced. Examine the wire-rope rigging for wear and rusted spots. It may be found necessary, because of previous strain, to untie the wire-rope rigging and resplice, taking up the slack. Grease the pulleys or, more properly, blocks. Remove loose cleats, fill holes with crack filler, rebore, and replace fittings. Sand spars smooth, filling any cracks and chafed areas with crack filler. Apply two coats of varnish, sanding lightly between coats. Paint well the centerboard trunk, centerboard, and rudder. If possible, remove sails during periods of disuse to prevent unnecessary mildewing. One of the drawings shows a simple sail cover that is well worth making. The boom scissors, also illustrated, is a useful device.

Twisted propellers are a prolific source of vibration and loss of engine revolutions. One of the photographs shows a method for testing propellers for blade alignment. If the blades are bent, return the prop to the factory for realignment. Even badly damaged props may be restored at a fraction of their original cost. Carefully remove dents and nicks by hammering and filing. Also test the alignment of the rudder, shaft, and strut. Repack stuffing boxes with graphited packing. Grease and oil a stern or V-drive.

New equipment that may be purchased or easily constructed will increase the enjoyment and satisfaction of boat ownership. The drawings show various items of this type.

## BURNISHED ALUMINUM FINISH FOR FRAMES

MANUFACTURERS of photograph frames use a special finish that is regarded as a trade secret, yet is very easy to duplicate in the home workshop. It consists in giving a highly polished silver or nickel appearance to any wood surface so that it can scarcely be told from nickel-plated metal that has been highly buffed. Ordinary aluminum paint is used, but the usual quantity of powder is doubled when mixed with the varnish. This can be applied with either a spray gun or a brush. When the finish is bone dry, burnish it with the bowl of a teaspoon or other smooth instrument, using a rubbing movement with considerable pressure. This causes the minute leaves of aluminum to flatten out into an even plate that has a high polish. With suitable tools, different designs can be burnished and the background allowed to retain its silver-gray appearance so that the polished parts stand out.—K. M.



By making templates and a layout board, any propeller can be tested for blade alignment, which is important from the standpoint of both speed and vibration.

# Old Bill Says...



**W**HEN you have any machine part or tool to caseharden and wish a certain section to remain soft, coat this particular part with coppering acid.

*Preserve as much as possible the original qualities of any cutting tool. Good maintenance is what determines its value.*

*An indexing head should always be used when sharpening formed cutters. Attempting to use a spring finger in this case is likely to lead to costly errors.*

*A safe way to prevent breakage of high-speed drills is to dip them in hot water before using. The sudden generation of heat while in use is not then so likely to cause cracks.*

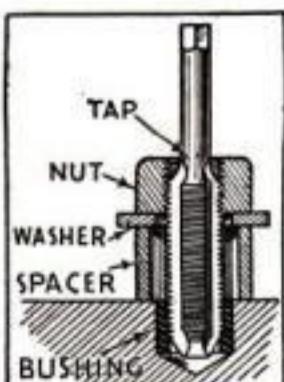
*An assortment of short pieces of scrap drill rod, which can often be obtained from a drill manufacturer, will prove useful and economical in any machine shop.*

*Once a canvas belt has stretched considerably, it can be shrunk by soaking it in boiling water for a few minutes and allowing it to dry overnight.*

*When a finished piece of deep-drawn work has to be duplicated, the size of the necessary blank can be found by cutting it to balance the work on the scales. This saves doing a good deal of figuring or solving the problem by the cut-and-try method.*

*You can't true up a scroll chuck unless you bind the jaws at the back end with a narrow piece of round stock. Then grind the front, remove the binder, and release the rear section.*

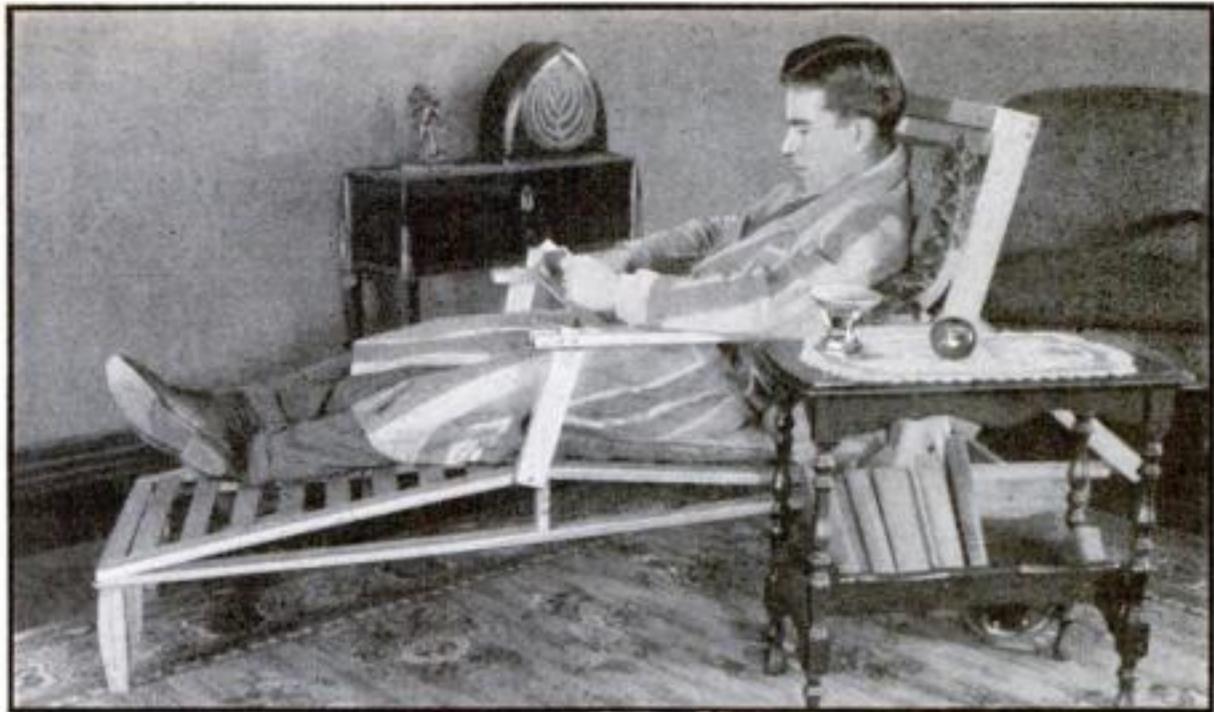
## BUSHING REMOVED FROM BLIND HOLE WITH TAP



Turning the nut removes bushing

WHEN no special tools are available, a quick method of removing a bushing from a blind hole is with a tap that will cut a fairly deep thread. Screw the tap in the bushing, and slip a spacer and a washer over the tap. Then screw a nut on the tap to lift the bushing from the hole. The spacer should be large enough inside to allow the bushing to slip up into it.

In all my experience I have never had this method fail, and the necessary equipment is to be found in nearly every shop.—O. N. GIEM.



## COMFORTABLE PORCH LOUNGING CHAIR CAN BE WHEELED AROUND

By Walter E. Stewart

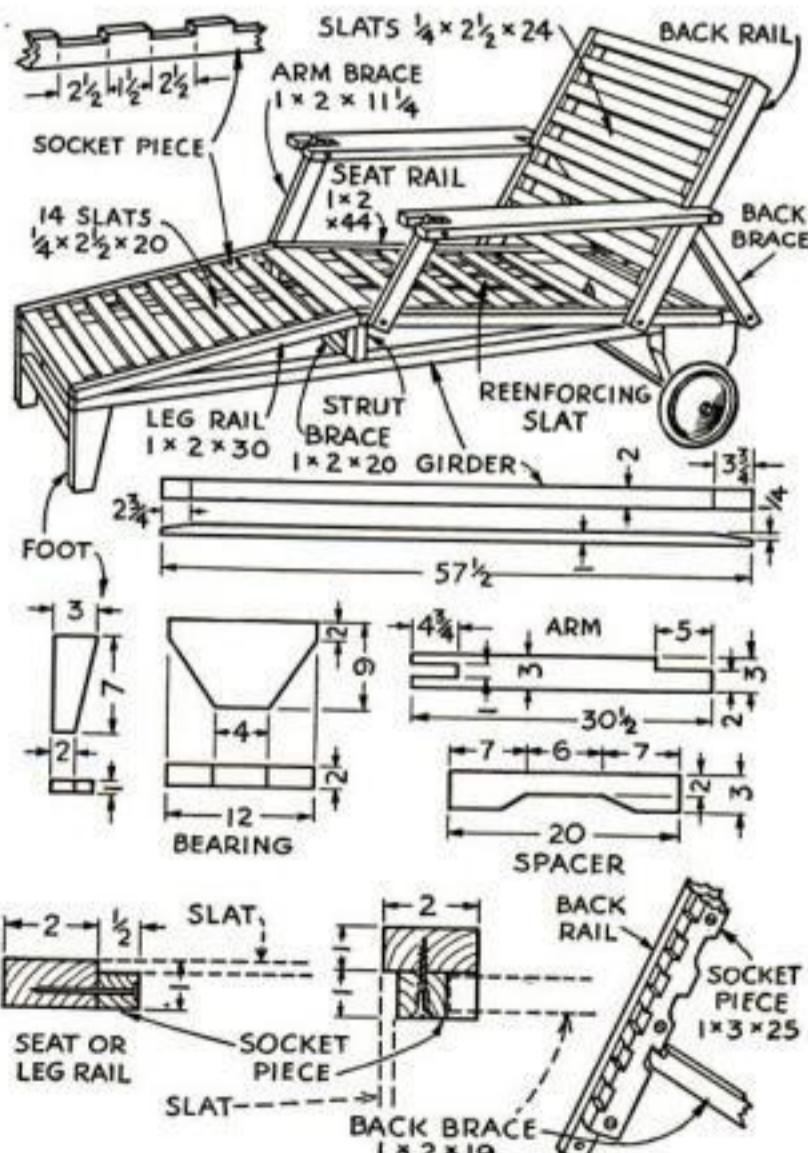
**T**HIS comfortable lounging chair for porch, lawn, or sun parlor can be moved about by a child, yet is sufficiently sturdy to put a two-hundred-pounder at ease. Thin wooden slats serve as springs, and loose cushions add the final touch of comfort. The back can be adjusted to three different angles.

The materials for the lounge shown cost \$2.75. The wheels came off an old cart.

Clear, strong wood such as spruce is required. Obtain the following and be certain that none of it contains knots: 4 pc. 1 by 2 in. by 10 ft., 4 pc.  $\frac{1}{4}$  by  $2\frac{1}{2}$  in. by 12 ft., 2 pc.  $\frac{1}{2}$  by  $\frac{3}{4}$  in. by 8 ft., 3 pc. 1 by 3 in. by 6 ft., and 1 pc. 2 by 9 in. by 2 ft. Add to this two wheels, an axle, sandpaper, varnish, nails, and screws, and with the ordinary hand tools found about any house you have everything that is needed.

The drawings show practically every detail. However, a few pointers may be of some aid. Be sure to cut the slots in all socket pieces before assembling them with the rails, because before assembly you can make saw cuts to the required depth and get out the material between in one stroke with a chisel. You will find it easier to do most of the sandpaper work before the parts are put together. The entire job can be greatly strengthened by running a 1 by 2 in. brace between the two struts, between the two foot supports, and another between the rails of the back rest. The back rest, arms, and back brace are pivoted with No. 14 brass screws.

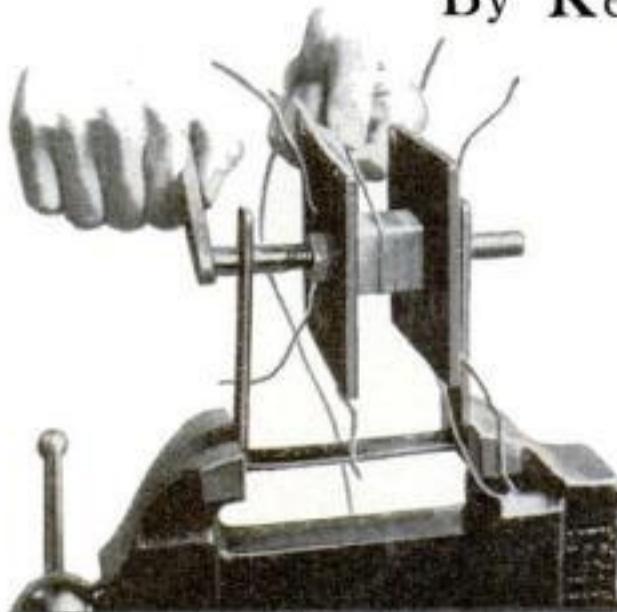
The finish depends on the type of furniture with which the lounge will be associated. If your porch furniture is varnished reed or bamboo, three coats of good spar varnish, sanded down between coats, will harmonize perfectly. For rustic furnishings, a dark oak stain, varnished over and rubbed dull with steel wool, will fit in quite well; for painted things, two coats of gloss deck paint give a durable and satisfactory finish.



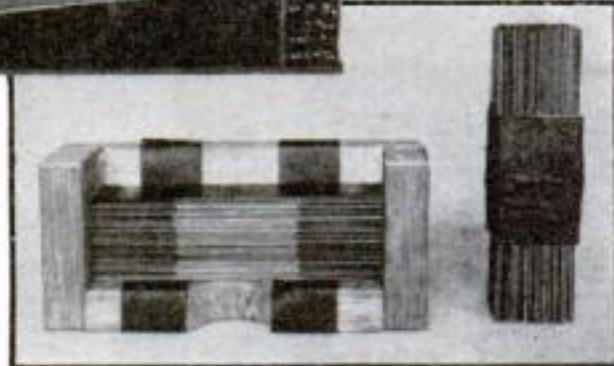
The assembled chair and details of the parts which have to be specially shaped. The remaining pieces are cut square

# EASILY BUILT Transformer OPERATES DOOR CHIMES

By Kendall Ford



How the winder is used. Note ends of short pieces of binding wire. At right: Method of stacking core, with a finished section standing at one side



**E**LECTRICAL experimenters who have constructed the door chimes described last month (P.S.M., May '34, p. 65) can easily make a suitable transformer.

The core is composed of 336 pieces of transformer iron .015 in. thick, cut to the size shown. Do not attempt to cut the laminations by hand. If squaring shears are not available, any tin shop will do the job for a very small charge. The transformer iron may be obtained from the salvage department of the local lighting plant, or No. 26 gage stovepipe iron may be substituted. The number of pieces required may vary somewhat; it will be necessary to have only enough to make four stacks, each of which is  $1\frac{1}{4}$  in. high.

Make a box  $4\frac{1}{8}$  in. long in which to stack the pieces, with a notch cut in the bottom to facilitate removing the core. Place two 6-in. lengths of friction tape in the core box near the end, and alternately stack the pieces as shown in one of the photographs. Bring the two ends of each piece of tape tightly together, and carefully remove the core from the box.

Clamp the core in a vise, allowing half of it to extend. Wrap two layers of tape around the solid portion of the core, reverse the core in the vise, and tape the opposite end. Give the tape a coat of shellac and allow to dry. Assemble two sections of the core in this way.

The primary winding consists of 550 turns of No. 22 D.C.C. wire wound on a wood core  $1\frac{1}{4}$  in. square and  $1\frac{1}{2}$  in. long. The details of a simple winding jig are shown. Place short pieces of wire in the slots, allowing the ends to protrude through the sides of the form. Wrap the wood center with two layers of thin cardboard. After the winding has been started, the wires in the slots may be bent out of the way. After 550 turns have been evenly wound, bring the ends of the short pieces of wire over the top of the coil and twist together. Remove the form from its support and take it apart by removing the end nut on the crank. Remove the wood center carefully, and tape the coil with cotton

tape. Short pieces of cotton sleeving or other insulating tubing should be slipped over the coil ends.

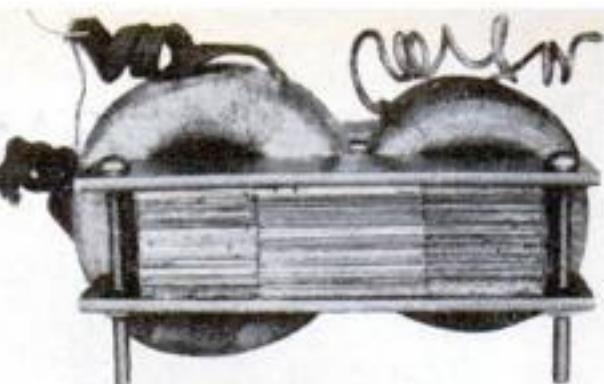
The secondary is wound in the same manner, but the number of turns required will be governed by the length and size of the bell circuit wires. The chimes will operate on 10 volts, but small wires and long circuits cause a voltage drop that must be provided for in the transformer. The table at the end of this article gives the number of turns required for the secondary, under any conditions that are likely to be met.

If, for example, the circuit is of No. 20 wire and 50 ft. long, wind 74 turns on the secondary winding. The size of the secondary wire in all cases should be No. 14 D.C.C.

After the coils are taped, they may be placed over the two core sections that were previously assembled, but first wrap the core with several layers of thin cardboard so that the coil will fit snugly. With the coils in place, stand the core sections on end and finish the assembly by inserting the remaining pieces of transformer iron as shown. The core pieces are forced together so that there will be no spaces between the side and end pieces. The laminations are then clamped together by means of pieces of flat iron and long machine screws. The side-view photograph shows the spaces between the core pieces before they are hammered together. In this case the flat iron clamps have been slipped over the core to show their position. Actually they should not be placed until the core pieces

have been forced together. If a small piece of wood and a hammer are used, the separate pieces of the core may be forced into place without disarranging the rest of the core.

The completed transformer should be placed in a metal box. A porcelain bushing should be inserted in one end of the box through which pieces of No. 14 rubber-covered wire are passed and connected to the primary coil for the 110-volt leads. The secondary leads should be brought out at the opposite end through fiber or rubber bushings. The transformer may be secured by covering the bottom of the box with melted pitch to a depth of  $\frac{1}{2}$  in.



Transformer with core clamp in place, but before the core pieces are forced together

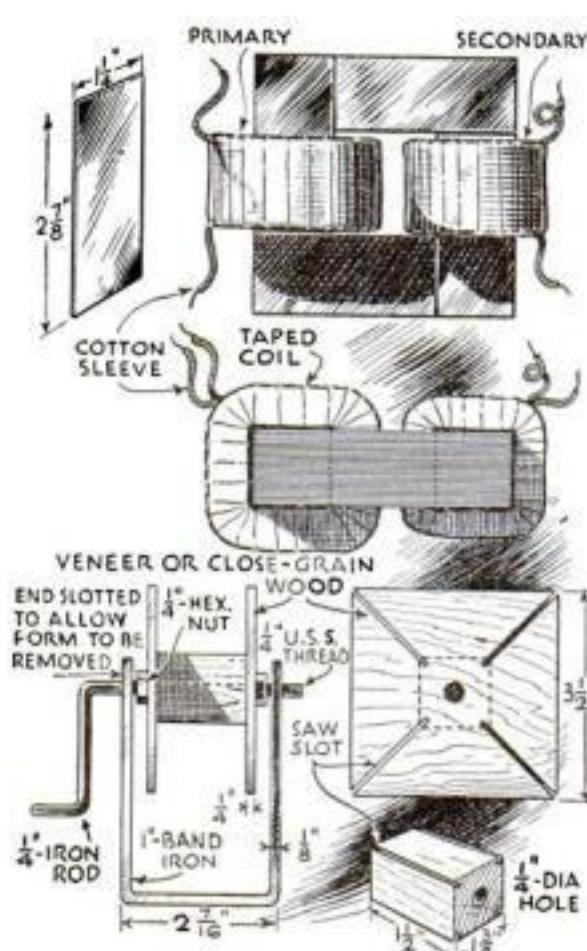
have been forced together. If a small piece of wood and a hammer are used, the separate pieces of the core may be forced into place without disarranging the rest of the core.

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Distance in feet from door button to transformer	No. of secondary turns	No. of secondary turns
	No. 18 wire	No. 20 wire
25	61	65
50	67	74
75	74	83

## ADVERTISING LANTERN SLIDES

THERE is enough cellophane around a pack of cigarettes to make a printed lantern slide. Any small advertisement in type, or a line etching or halftone cut, can be printed on the cellophane with ordinary printer's ink, but the best results are obtained when special celluloid ink is used. If regular ink is used, be reasonably careful when placing the printed cellophane between two pieces of glass preparatory to placing the slide in the projector. The printing can be done on a proof press or a job press.—J. H.



The assembled transformer, one of the core laminations, and details of the winding jig

## Prize Winners in Final Photo Contest

**I**N THE final indoor photo contest of our winter series (P.S.M., Feb. '34, p. 68), the judges, after a careful comparison of the many excellent entries, have awarded the prizes as follows:

**FIRST PRIZE, \$25**  
Mrs. Emily Sammons, Milwaukie, Ore.

**SECOND PRIZE, \$15**  
Wallie Keller, St. Joseph, Mo.

**THIRD PRIZE, \$5**  
Earl Seifert, Milwaukee, Wisc.

**FIVE PRIZES, \$1 Each**

R. A. Geisel, Philadelphia, Pa.; Nick Bruehl, Sherwood, Wisc.; Jacob C. Kistinger, Maspeth, N. Y.; Austin Armer, Fort Wayne, Ind.; M. Marossian, Berkeley, Calif.

**HONORABLE MENTION**—Charles J. Belden, Pitchfork, Wyo.; Frank E. Crane, Jr., Newark, N. J.; E. A. Creswick, Toronto, Canada; Mary Welles Hutchins, New York, N. Y.; J. P. Johansson, Milledgeville, Ill.; C. B. Paul, Moline, Ill.; Harry Singer, New York, N. Y.; Mrs. J. H. Tooke, Winnipeg, Canada, and W. R. Van Loan, Noroton, Conn.

ARE YOU  
A  
**KEY  
JUGGLER?**



Copyright, 1934, R. J. Reynolds Tobacco Company

## Watch out for the signs of jangled nerves

You've noticed other people's nervous habits—and wondered probably why such people didn't learn to control themselves.

But have you ever stopped to think that *you*, too, may have habits that are just as irritating to other people as those of the key juggler or coin jingler are to you?

And more important than that, those habits are a sign of jangled

nerves. And jangled nerves are the signal to stop and check up on yourself.

Get enough sleep—fresh air—recreation—and watch your smoking.

Remember, you can smoke as many Camels as you want. Their costlier tobaccos *never* jangle the nerves.

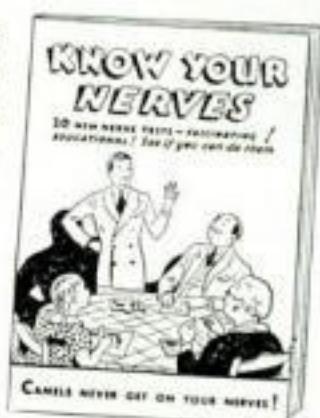
### COSTLIER TOBACCOS

Camels are made from finer, MORE EXPENSIVE TOBACCOS than any other popular brand.



*How are YOUR nerves?*  
THIS FREE BOOK WILL TELL YOU

Shows 20 ways to test nerves—all illustrated. Instructive and amusing! Try them on your friends—see if you have healthy nerves yourself... Mail order-blank below with fronts from 2 packs of Camels. Free book comes postpaid.



### CLIP AND MAIL TODAY!

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Dept. 95-A, Winston-Salem, N. C.

I enclose fronts from 2 packs of Camels.  
Send me book of nerve tests postpaid.

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Offer expires December 31, 1934

# CAMELS

SMOKE AS MANY AS YOU WANT

...THEY NEVER GET ON YOUR NERVES

The "DATE-LINE" tells you

*they're fresh*

"WE ARE ADRIFT"—FLASHLIGHT SIGNALS READ.

Standing up in the rocking, disabled dory, in which he and John Boyle\* had drifted 100 miles in a gale-lashed sea, George Bell\* sent those signals into the night from a large size hand-flashlight. And those signals, seen on a trawler . . . saved these two fishermen.

\*Not their real names, of course, although they were given in the coast-to-coast newspaper report.



There's the date-line! You'll find it on all Eveready Flashlight Batteries . . . a guarantee that THEY'RE FRESH.



PETS ARE A SERIOUS MENACE—

when they take to sleeping on unlighted cellar stairs . . . in any unlighted spot for that matter. Play safe; send the brilliant beam of your flashlight ahead of you.



YOU FILL up your flashlight with Eveready Batteries. You snap the switch . . . and swift sure light stabs the darkness every time. Of course there are reasons . . . although you may never have known them.

Right near the top of the list of reasons is *freshness*. Brimful of long-life, each Eveready you buy is *fresh* because your dealer sells Eveready Batteries so fast they've no chance to lose their power . . . to die on his shelves.

And besides *freshness* there are many more reasons . . . indeed, that compact Eveready you've bought for only a dime is the tangible result of 40 years of battery making. 40 years of designing, checking, refining and improving. Perfecting the balanced mix of the six *active* chemicals that produce the light you want. Working out such things as the "power-stabilizer" which holds these powerful light-making elements on tiptoe . . . ready to light. Designing the metal top, which prevents power from leaking away when the batteries aren't in use. All these things are back of the "date-line" with its guarantee that the Eveready Batteries you buy for your flashlight are *fresh*.

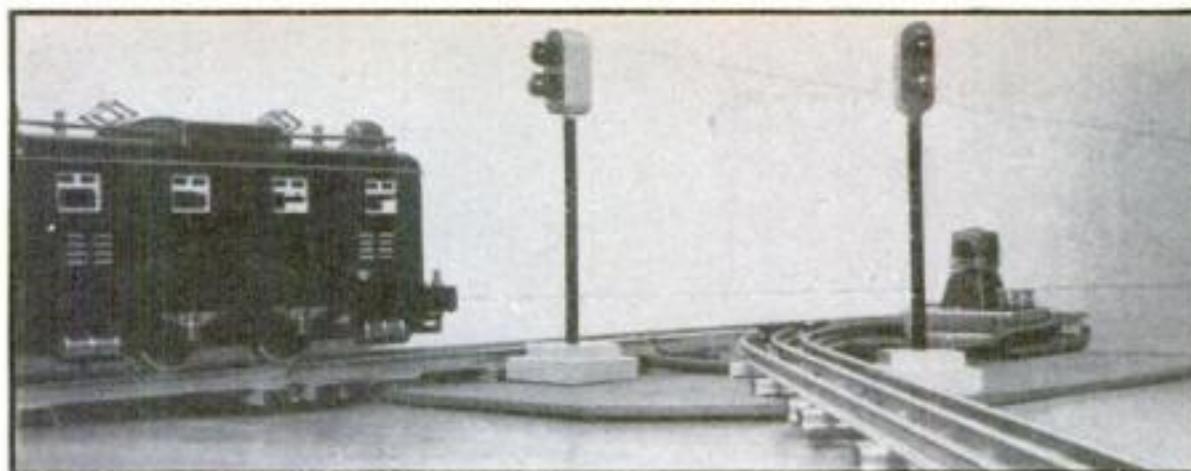
Bringing Evereadys to such a peak of perfection costs money. But in the end it pays . . . pays us, and you, too. For it's your insurance that whenever you buy an Eveready Battery . . . for a flashlight, a radio, a bell, a buzzer, or motor ignition . . . you're sure of getting packaged electricity at its best. National Carbon Company, Inc. General Offices: New York, N. Y. Unit of Union Carbide and Carbon Corporation.

Thousands of radios in unwired homes are powered by Eveready Air-Cell "A" Batteries and Layerbilt "B" Batteries. Eveready Dry Cells serve hundreds of uses in the home and in industry.



**EVEREADY  
BATTERIES**

*packaged electricity at its best*



## NEW FOOLPROOF Switch Prevents Wrecks *on Model Railways*

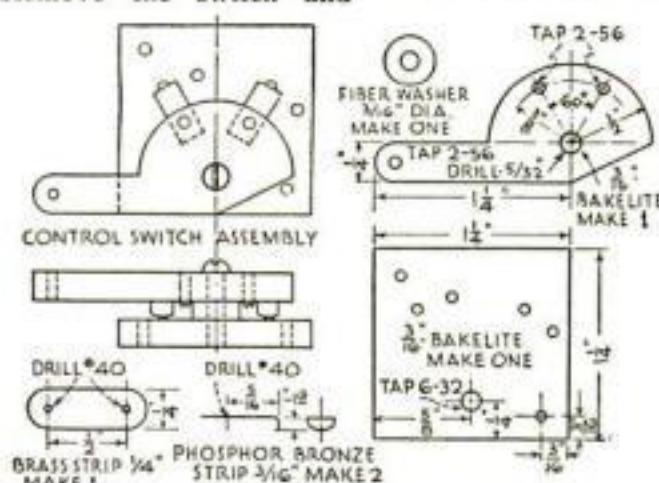
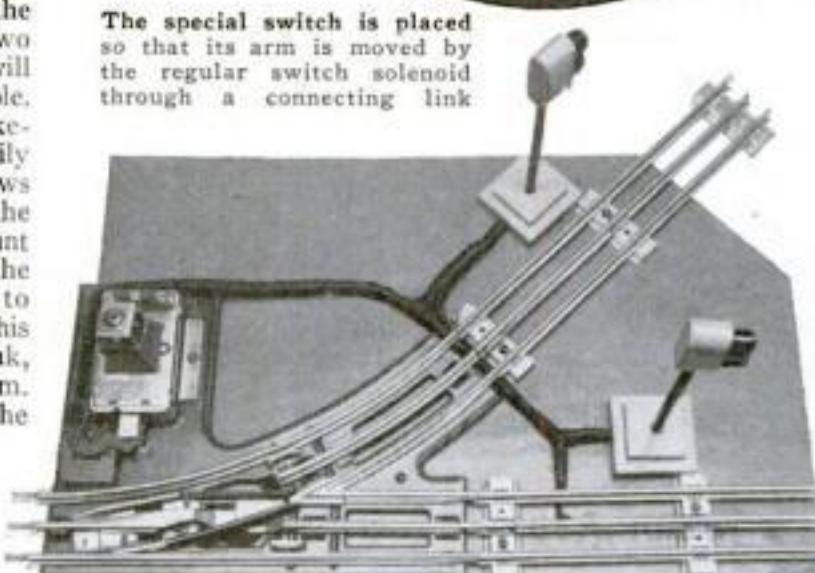
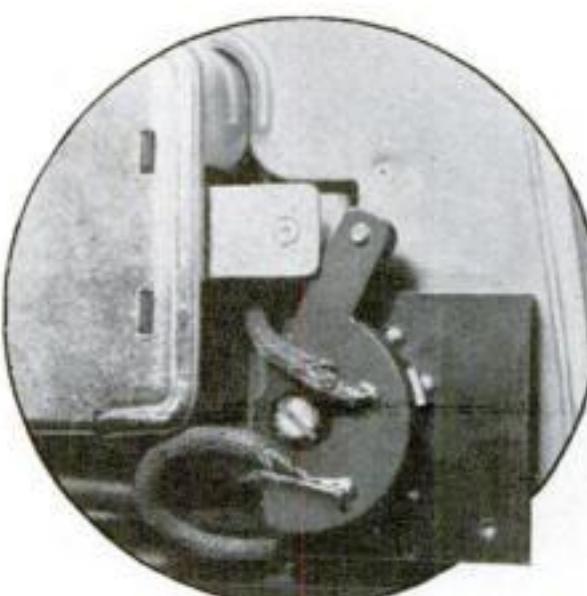
By John B. Eggengerger

**M**ODEL railway switches like the one illustrated are simple to construct and prevent all possibility of wrecks by stopping the train if the switch should happen to be set against it and automatically start the train when the switch is thrown to the proper position. They are essentially a new nonderailing type of switch.

Each switch consists of a standard electrically operated switch with isolated sections of third rail on the main line and branch line entering the switch. Miniature color light signals (see P. S. M., Jan. '31, p. 86) and a small double-pole, double-throw switch operated from the track-switch solenoid are the only items to be constructed.

The detail drawings of the switch are self-explanatory. Two points of caution, however, will save time and avoid trouble. Mount the square piece of bakelite on the base temporarily with the 2-56 machine screws before drilling the holes for the escutcheon pins. Then mount the switch arm and locate the hole for the connecting link to the solenoid. Drill and tap this hole, fasten the connecting link, and replace the switch arm. Throw the track switch to the main line and locate the holes for the escutcheon pins, and do the same thing with the track switch thrown to the branch line. Remove the switch and

The special switch is placed so that its arm is moved by the regular switch solenoid through a connecting link

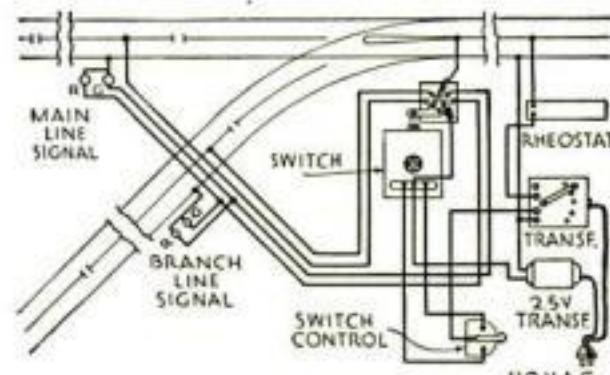


The assembled control switch and details of parts

drill these holes so as to be a snug fit for the 1/2-in. No. 18 escutcheon pins. These should be bent over and long leads soldered to each. The switch can then be permanently mounted with a small piece of cardboard or other insulating material between it and the track-switch base.

As shown in the wiring diagram, two changes are made in the existing wiring of the switch which make for simpler and more realistic operation. First, the rubber-covered wire running from the third rail to the solenoid is removed from the third rail and grounded on the frame. The supply is connected from the transformer to the double-throw momentary contact

switch, thereby making the operation of the switch independent of the operation of the train. Second, the middle binding post (white) on the terminal block is removed from the base, the hole in the base is enlarged, and the binding post replaced. Formerly grounded, this post now supplies the signal lantern (green silk-covered wire) and the arm on the double-pole switch supplying the new semaphore lights. This likewise makes the lights independent of the train, and both these features are accomplished without any addition-



How the switch is wired. Only two changes are needed in the existing three-wire system

al wiring to the switch other than the original three wires used for the operation of the switch. This is very desirable when the system is periodically set up and taken down.

The length of the isolated section of third rail should be sufficient to prevent the train from coasting beyond and entering the switch. This can be best determined experimentally with your own train. Don't overlook the necessity of having the third rail beyond the isolated section of track alive either through the track layout or by means of an additional track connection.

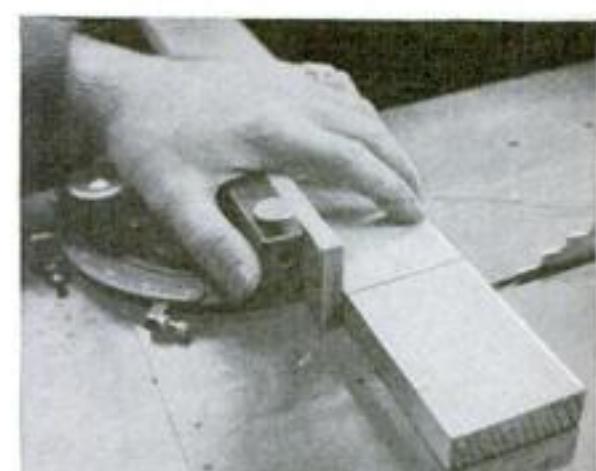
A separate supply of 2.5 volts is used for signal lights since this enables the use of the small focusing type flash-light bulbs of that voltage. These lamps, dipped in red or green lacquer, are more realistic than the higher voltage bulbs, which are much larger in size.

### STRIPPING SHIP MODELS

To FORM thin stripes on a 6 1/2-in. model of the *Sea Witch*, I stretched out four ordinary sewing threads by gluing them to two blocks of wood, then gave them two coats of paint to blend the four threads into a single band, and applied the flexible 1/16 in. wide stripe to the hull.—HAROLD KROLL.

### WOODEN GAGE IS AID IN CROSSCUTTING TO LINE

AMATEUR woodworkers who are just learning to use a circular saw will find that they can save time in crosscutting if they screw a short piece of wood to the miter gage and then pass it over the saw. This will leave a short stump, as shown in the illustration,



The mark on the work is lined up with the cut-off end of the wooden piece on the gage

which may be lined up with a pencil mark on the work. In this way it is easy to cut exactly to the line.—GEORGE S. GREENE.

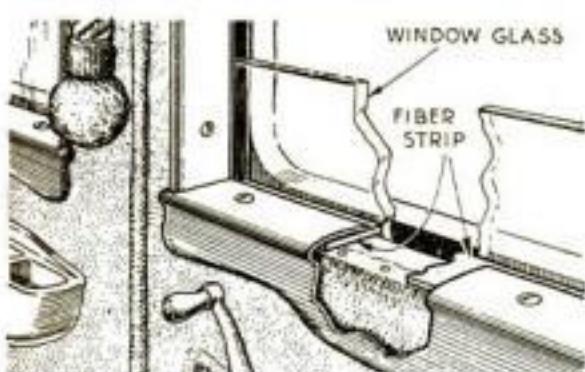


### Rack for Valves

A HANDY aid for the amateur mechanic who services his own car is the simple valve stick shown above. Made by drilling a series of holes in a strip of ordinary wood lathing, it serves as a rack for the valves as they are removed from the cylinder block. Placed in line with the motor, it holds the valves in their proper order.—R. R. K.

### Stops Window Rattle

TO STOP a monotonous window rattle in my closed car, I recently removed the sill, cut a piece of fiber (heavy cardboard would have served) to fit tight against the window pane, and fastened it under the sill by means of the regular mounting screws that hold the sill in place. After this was installed on all windows, I found that it not only stopped the rattles but helped to keep out drafts as well.—J. P.



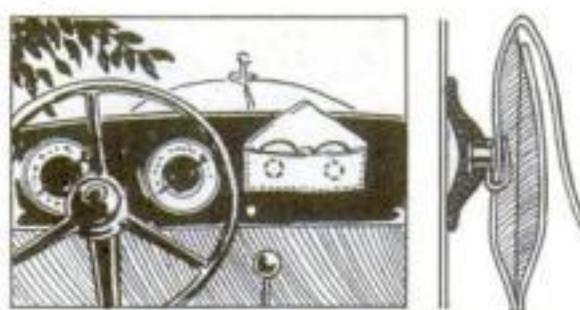
Piece of fiber, cut to fit the pane snugly, is fastened under sill and stops window rattle

### Holder for Eyeglasses

DESIRING a safe, convenient storage place for his driving glasses, the writer made the inexpensive holder shown. It consists of a thin leather case provided with two small suction cups to hold it in place. The cups make it possible to place the holder on the dashboard, windshield, or any convenient flat surface. To obtain

A series of holes in an ordinary strip of wood lathing, serve as a rack to hold valves when they are removed from the cylinder block for cleaning

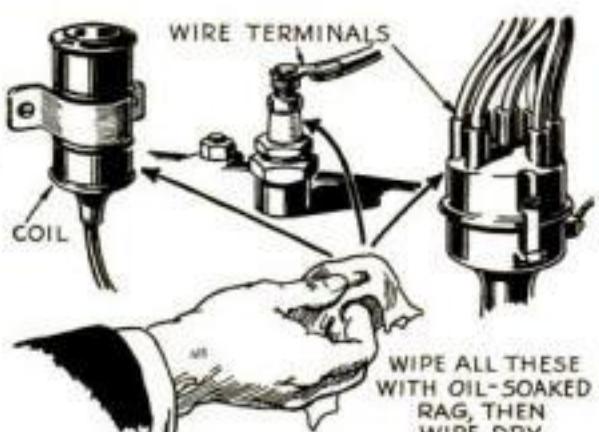
of the case. Of course, if desired the cups can be sewed or cemented to the rear of the case. Incidentally, a flexible leather eyeglass case of this type often can be obtained from a neighborhood oculist for very little.—E. W. B.



Fastened to dashboard or windshield with suction cups, this case holds driving-glasses

### Drying Wet Ignition

WHEN a wet ignition system makes it impossible to start your car, rub the coil, spark plugs, distributor cap, and wire terminals with a cloth dipped in motor oil. Wiping with a dry cloth then will remove every trace of the moisture along with the oil. I have used this method on several occasions after a heavy rain soaked the motor and it has never failed to give quick and satisfactory results. Once, when a cloth was not handy I used a crumpled ball of old newspaper.—R. F. E.

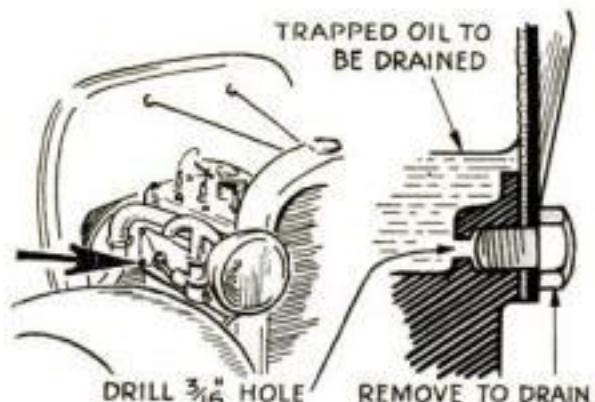


To start a car when ignition is wet, wipe parts with motor oil and then dry with soft cloth

# AUTO IDEAS

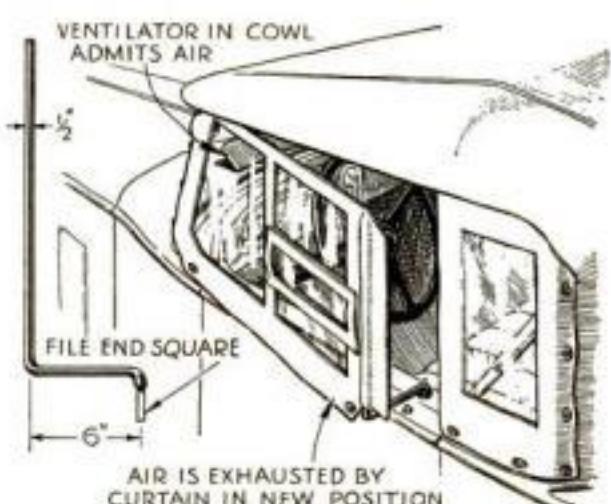
*Hints for Car Workers  
Supplied by Our Readers*

suction cups of the right size, two fixtures generally used for holding cards or menus in store windows were purchased for five cents each. The spring clips were cut off and the strip of metal remaining bent into the shape of a hook and inserted in a slit cut in the rear



### Draining Valve Chamber

ON LIGHT four-cylinder cars having an oil compartment in the valve chamber for supplying the rear main bearing with oil, an accumulation of thick oil and dirt sometimes is trapped in the compartment. Ordinary engine draining has little effect on this trapped muck but by following the suggestions outlined in the drawing above, the amateur mechanic can supply a drain hole. Simply remove the bottom bolt at the rear of the valve chamber and drill a 3/16-in. hole through the bottom of the bolt hole into the chamber. Then removing the bolt at oil-changing time will provide an exit for the thick oil. The bolt must, of course, be replaced tightly before starting the motor.—C. T. S.



### Improving Side Curtains

WITH a few changes, the side curtain equipment of open roadsters can be altered to give a modified form of draftless ventilation. As shown in the illustration, the only change necessary consists of making two new supporting rods to fit the mounting holes in the top edge of the door. The new rods, bent from 1/2-in. round stock, should have a 6-in. offset instead of the 2-in. elbow supplied on the stock equipment. The additional bend serves to hold the rear edge of each curtain away from the car. The cowl ventilator then can be adjusted to supply intake air.—E. A. K.

# WARNING!

EVERY YEAR THOUSANDS ARE KILLED OR INJURED  
WHEN BLOW-OUTS THROW CARS OUT OF CONTROL



## *Look!* SEE HOW GOLDEN PLY TIRE SAVES LIVES

... how it prevents great cause of **blow-outs**  
... gives months of extra mileage free!

### "2 Killed; 1 Injured as Blow-out Throws Car Out of Control."

TRAGIC headlines like this appear in the newspapers nearly every day. Due to higher speeds and whirlwind revolutions of smaller wheels, tires are running hotter and hotter. And heat causes invisible blisters which grow and grow until BANG! A blow-out! The human toll is terrific. Something had to be done.

Goodrich engineers worked like beavers. Night and day. For months. Finally they struck it. The amazing Life-Saver Golden Ply. An invention that actually resists this intense heat—that makes "the safest tire ever built" 3 times safer from blow-outs at high speeds—gives months of extra mileage. These claims are not just shop talk. And here's proof!

Racing daredevils tested the Golden Ply out at breakneck speeds. On the world's fastest track. Gave it everything

they had. Rubber got so hot it fairly smoked. *Not one blow-out.* Similar tires without the Life-Saver Golden Ply failed at one third the distance the Golden Ply Silvertowns were run.

### NO EXTRA COST!

Remember, you pay no price premium for this extra safety—this extra mileage. The new Goodrich Silvertown with the Life-Saver Golden Ply costs no more than other standard tires. So why take **NRA** chances? Get a set of Goodrich Safety Silvertowns now.

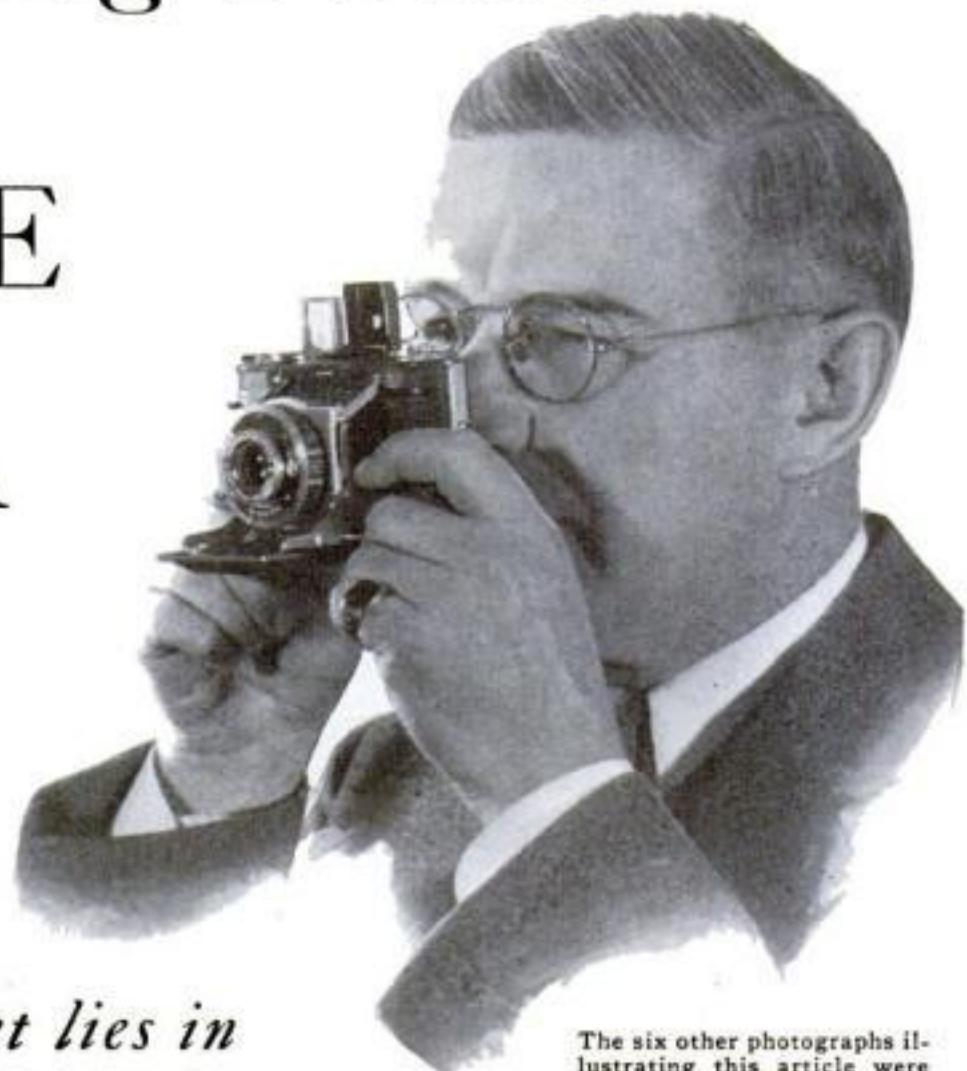
**FREE!** Handsome emblem with red crystal reflector to protect you if your tail light goes out. Go to your Goodrich dealer, join Silvertown Safety League, and receive one FREE. Or send 10¢ (to cover packing and mailing) to Dept. 357, The B. F. Goodrich Rubber Co., Akron, O.



*The*  
**NEW** **Goodrich**  
Copyright, 1934, The B. F. Goodrich Rubber Co.

*Safety* **Silvertown**  
WITH LIFE-SAVER GOLDEN PLY

# HOW TO GET Flawless Big Pictures WITH A MINIATURE CAMERA



**I**F YOU were the size of a gnat, you'd see that what we call a fine, sharp, photographic negative is really a huge expanse of transparent gelatin with a lot of black lumps buried in it. As you crept along the surface of the gelatin, you'd see that what we'd call a fine line in the negative was really only a place where the thick clusters of black lumps thinned out rather rapidly into an area where there were only a few scattered lumps. You wouldn't see any line at all.

Of course, what you'd see in a photographic negative if you were the size of a gnat isn't of any importance if you are only going to look at a print made directly from the negative. If you couldn't see the grain in the negative, you wouldn't see the individual particles in a contact print.

Making an enlargement is another story, however, because photographic enlarging brings out the defects as well as the good qualities of any negative. The greater the enlargement, the more nearly you approach the gnat's-eye point of view, and that is why defects not noticeable in a contact print or even a two-diameter enlargement become eyesores when you push the magnification up to five or ten diameters, as is necessary with all nega-

By  
Frederick  
D.  
Ryder, Jr.

*The secret lies in using fine-grain film and developer*

tives taken with a miniature camera.

In order to show you what fine-grain development actually means, or in other words to give you a real gnat's-eye view of film grain, I have made the set of prints shown on page 86. The first is a picture taken in a cellar to show the boiler set-up. This was made from an 8 by 10 in. enlargement of a miniature film measuring 3 by 4 centimeters (sixteen pictures on No. 127 film), so that the illustration is about a two-diameter enlargement.

Now imagine yourself no bigger than a gnat and look at the first of the two enlargements which take in the upper half of the dial of the boiler's pressure gage. As shown in the magazine, this is from a thirty-six-diameter enlargement of the same film from which the boiler picture was made—an area on the original film  $1/32$  in. high by  $1/16$  in. wide. The film was panatomic panchromatic developed in

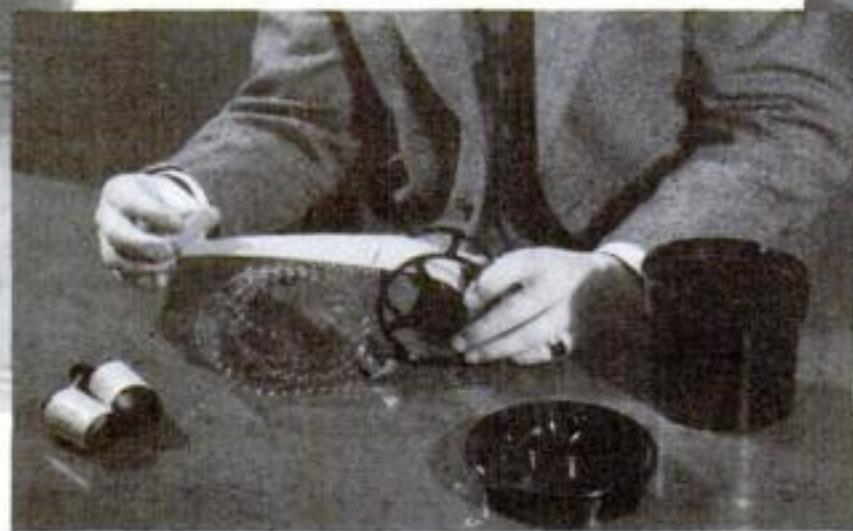
The six other photographs illustrating this article were all made with this midget sixteen-exposure camera

fine-grain developer. Incidentally, all the illustrations for this article except the one that appears above were taken with the midget camera shown in that illustration and on this same film. Fine-grain development, of course, was used.

Next look at the second of the pressure-gage enlargements. Here is exactly the same degree (*Continued on page 86*)



For hand development of miniature film, a jelly glass serves better than a tray, the glass being so smooth it does not leave scratches

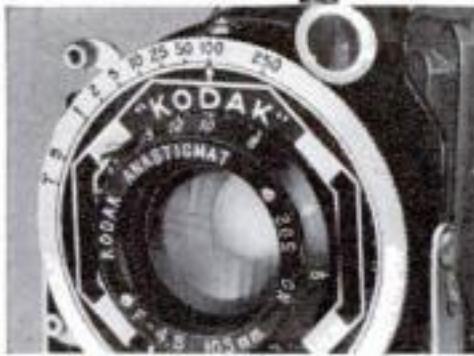
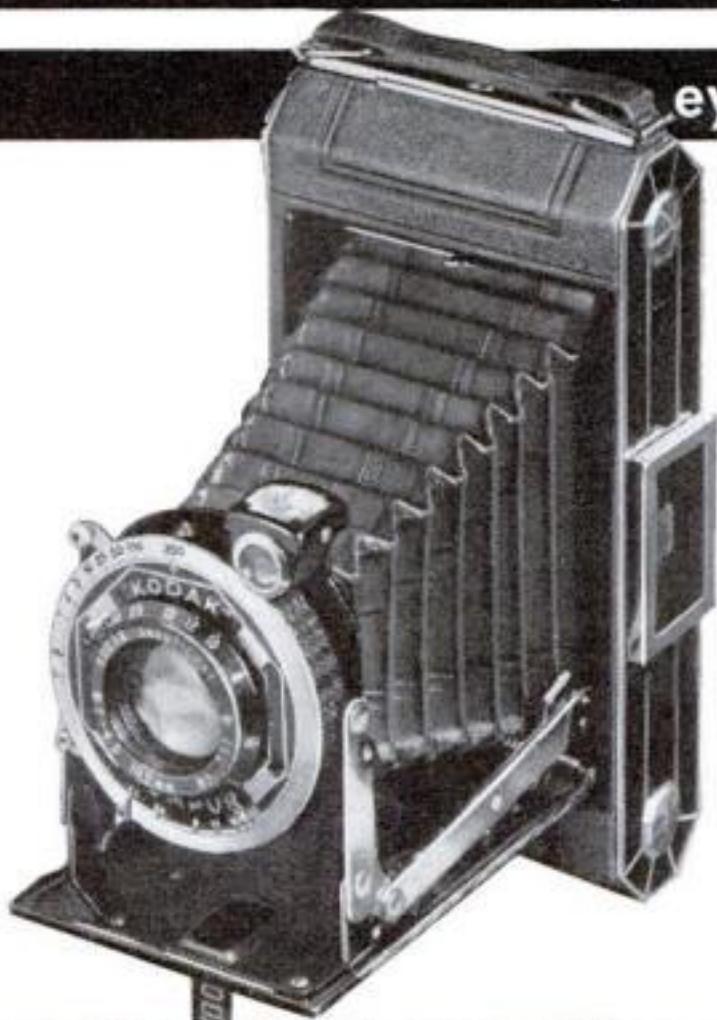


When the film has been well washed and hung up, it is wiped gently to speed drying and prevent water marks

In tank development, a celluloid film with dimpled edges is wound on a skeleton bakelite reel along with the film. The dimples enable the solution to circulate more freely

f.4.5 lens • 8-speed Compur shutter • action front

eye-level finder • built-in self timer



**PRECISION** . . . a detailed view of the lens and shutter, including the self timer, the focusing lens mount, the Compur shutter with its 8 speeds.



**CONVENIENCE** . . . the new Six-20 is easy to use. Two finders give you a choice of picture-taking positions. Here you see the eye-level finder in use.

#### KODAK "SS" PAN FILM

Eastman super sensitive films are the favorite films of Hollywood studios, of news camera men and portrait photographers. Here's one of them you can get in rolls or packs to fit your camera . . . Kodak SuperSensitive Panchromatic Film. You will be amazed at its extreme speed, full color sensitiveness and tone values. It is the ideal film for indoor snapshots . . . three times as fast as ordinary film under artificial light. Ask your dealer for Kodak "SS" Pan Film.



#### A DE LUXE MODEL OF THE CINÉ-KODAK EIGHT

... most versatile of all the "Eights" . . . the model 60 makes movies indoors or out—on bright days or dull. It has an f.1.9 lens . . . interchangeable with a telephoto lens. Makes 20 to 30 scenes on a \$2.25 roll of film. Price of film includes finishing. Beautifully finished inside and out . . . covered with leather. Complete with carrying case — \$91.50. Telephoto lens, \$37.50.



IF IT ISN'T AN EASTMAN, IT ISN'T A KODAK

... all these features  
plus ROLL FILM CONVENIENCE

## in the 1934 KODAK SIX-20

A MARVEL of precision, compactness, and beauty . . . the new f.4.5 Six-20 Kodak will instantly appeal to those who know cameras.

It opens at the touch of a button—the fast f.4.5 Kodak Anastigmat lens and the Compur shutter with its speeds from 1 to 1/250 second give you mastery of light and action. Both conventional and eye-level finders make this camera flexible to use . . . and with the self timer, you can get in the picture yourself.

Makes 2 1/4 x 3 1/4-inch pictures. Completely equipped—the Six-20 with f.4.5 lens costs \$37.50.



#### ALL THE PRINTS YOU WANT . . .

when you develop your own—and it's really quite easy to do. Kodak Darkroom Outfit (shown above) contains all the equipment and chemicals needed for a complete home darkroom. Entire outfit—complete in fiber case—\$8.75.

FREE . . . latest  
Kodak catalog



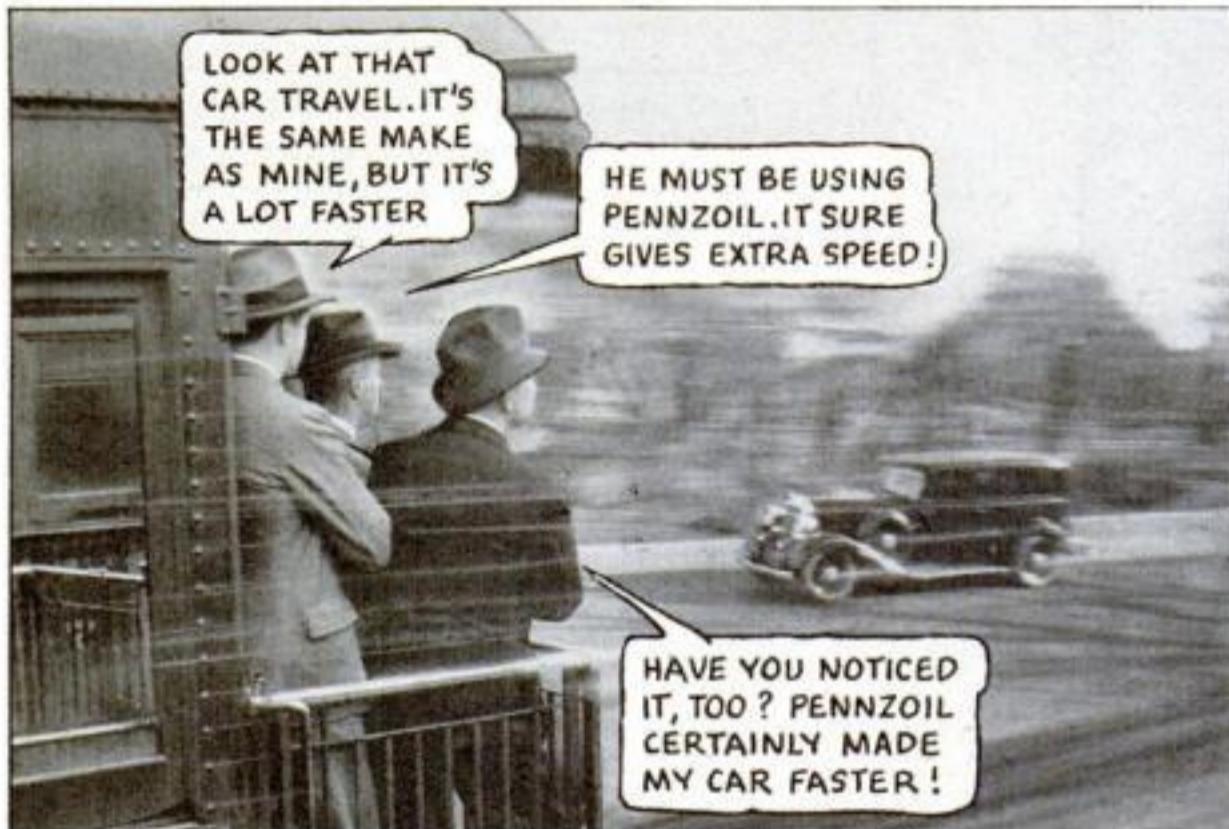
Eastman Kodak Company, Rochester, N. Y. Gentlemen: Please send me a free copy of your latest catalog. I am particularly interested in more information about: The new f.4.5 Kodak Six-20 □ Ciné-Kodak Eight □ Kodak Darkroom Equipment □

Name \_\_\_\_\_

Address \_\_\_\_\_

P. S. 6-34

# MOTORISTS THRILLED AS SPECIAL OIL INCREASES SPEED AND PICK-UP



**Remarkable Tough-Film Motor Oil increases speed, saves up to 12% on gas alone, and costs no more**

An oil that can save gas and increase speed is good news to any motorist. But to get this special oil at the same price you pay for any other quality oil... That is front page news!

All you have to do is ask for the correct grade of Pennzoil for your car. That's all.

#### What Pennzoil is

Pennzoil is refined by a special process from the finest Pennsylvania crude—it is 3 times concentrated to give it an amazing Tough-Film and far better lubricating qualities. This cuts down engine drag so remarkably that speed is increased. Your engine runs easier. Your car smoother and freer. Much less gas is used.

#### Breaks 14 World Records

Pennzoil is so much better, that Ab Jenkins in his Pierce Arrow broke 14 major world records from 200 to 3000 miles—using a light grade of regular Pennzoil. He drove at the unheard-of speed of nearly 2 miles a minute for over 24 hours, day and night, without relief, without changing cars!

No other oil had ever stood this blistering speed test! Not even the most costly racing

grades of special castor oil had ever enabled a car to go so far so fast!

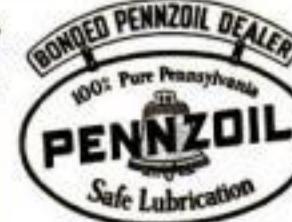
#### Try Pennzoil Today!

If you want to make your car go faster—increase pick-up 10 to 25%—save money on gasoline—then start today to use Pennzoil. Know that you're using the oil proved best for today's modern high speed motors. Save a lot of money in the bargain. Get Pennzoil today from any Bonded Pennzoil dealer.



**THE PENNZOIL COMPANY**  
Executive Offices: Oil City, Pa. : Los Angeles, Calif.  
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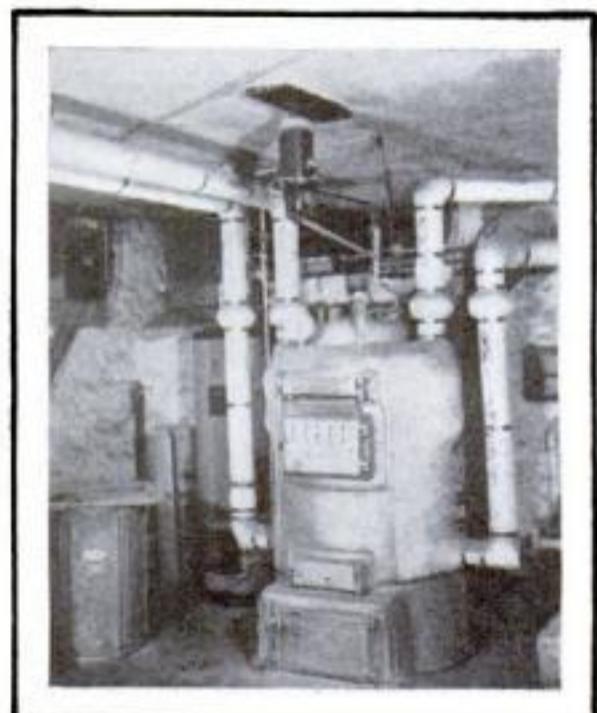


Member Penn. Grade Crude Oil Ass'n., Permit No. 2

**Tough-Film  
PENNZOIL**  
MAKES CARS GO FASTER...SAVES ON GASOLINE

#### BIG PICTURES WITH MINIATURE CAMERA

(Continued from page 84)



This picture of a boiler set-up is a two-diameter enlargement of a miniature photo

of enlargement from panchromatic film developed in developer of the ordinary type.

The secret of successful photography with a miniature camera lies, therefore, in choosing the finest grain film you can get and in seeing that the film is so developed that the coarse, grainy effect which would ruin the picture is minimized by special fine-grain development.

As things stand today, there are photo finishers in various parts of the country who have put in special equipment to handle miniature film developing, but the majority have not. So, unless you can locate a finisher who makes a real speciality of fine-grain



Part of the pressure gage enlarged thirty-six diameters. The upper view shows the improvement caused by fine-grain developer

miniature film developing, it is better to do the job yourself.

The general procedure follows the usual routine of developing, washing, fixing, washing and drying. The difference is in the kind of developer used and in certain details of manipulation.

There are a number of fine-grain formulas. The most popular, practical, and economical, all things considered, is the metol-hydroquinone-borax formula. Here it is:

Eton or metol	115 grains	or 8 grams
Sodium sulphite	13 1/4 ounces	400 grams
Hydroquinone	290 grains	20 grams
Borax	115 grains	8 grams
Potassium bromide	44 grains	3 grams
Water to make	1 gallon	4 liters

(Continued on page 87)

## BIG PICTURES WITH MINIATURE CAMERA

(Continued from page 86)

Here is the way to mix it: Dissolve the elon in about 8 ounces of warm water (125°) and pour into a gallon bottle. Then dissolve one third of the sulphite in about a quart and a half of hot water (160°); when completely dissolved add the hydroquinone, and when that is dissolved pour into the bottle. Now dissolve the rest of the sulphite in two quarts of hot water (160°) and add the borax and the bromide. When these are dissolved, pour into the bottle and fill it to the neck with water.

The developer will keep much better if you boil all the water before cooling it to the temperature specified for mixing.

THE next procedure is to syphon the developer, with the aid of a rubber tube, into small bottles. Fill each one to the top and close it with a tight-fitting rubber stopper. Don't use ordinary corks; they rarely give a truly air-tight seal.

The size and consequently the number of small bottles depend on how you expect to use the developer. If you equip yourself with one of the special miniature film tanks such as that illustrated, get 16-ounce bottles, because the tank holds 14 ounces. Each bottle can be used for at least three rolls of film or up to five rolls if you keep your exposures on the full side. This means that a gallon of developer which costs you about 45 cents for chemicals will develop up to forty rolls of film at a trifle over a cent a roll!

As the developer, when mixed with boiled water and bottled this way, will keep in the unopened bottles for at least a year, you won't have to mix developer very often.

If you have no tank, equally good work can be done by hand developing each roll in a jelly glass as shown in one of the photographs. The jelly glass, I have found, is even better than a tray for the development of miniature films.

The time of development depends both on the type of film you use and whether done in a tank or a jelly glass. Develop panatomic type panchromatic film 12 minutes by hand in the jelly glass or 15 minutes if the tank is used. The developer temperature should be 65°.

WITH supersensitive type panchromatic film the time should be 18 minutes and 22 minutes respectively.

The difference in time between the tank and the tray method is due to the difference in the amount of agitation the film receives. The times given are based on rotating the tank every few minutes. If the tank is kept in continuous motion, the time should be the same as for tray work.

After development the film should be rinsed for a minute or two in water and then fixed in the usual acid hypo solution till the yellow clears away. The final washing should be 20 minutes in running water; then the film should be hung up to dry where there is a slow circulation of air. As soon as hung up, both sides should be gently wiped with a fresh piece of absorbent cotton which has been squeezed nearly dry or until all the excess drops of water have been removed. This wiping is important and should not be omitted. It prevents water-drying marks and also removes any specks of sediment that may have settled on the film in the solutions. Cleanliness is of the utmost importance in all photographic processes and particularly so in handling miniature films.

For a list of winners in the fourth of our winter series of indoor photo contests, see page 80.



Attendant: "If you're using more gas than you think you should, have your spark plugs cleaned. Dirty plugs will waste as much as 10 per cent of gas."



Mother: "I hope the car will start today. I had a terrible time with it yesterday."

Sonny: "Dad had the spark plugs cleaned, Mother. The garage man said that was all that was the matter."



Father: "Say—we don't need a new car! I had the spark plugs cleaned this morning, and you'd think this was a different automobile! Talk about pep and speed—it has it!"



Driver: "It's 'oke,' Boss. The shop cleaned the plugs last night and the old truck is pulling the way it did when it was new! You can count on this truck, now."



DIRTY OR WORN PLUGS WASTE GAS



Before Cleaning \*

After a few thousand miles, oxide coating, soot and carbon coat spark plug insulators—wasting gas and impairing performance.



After Cleaning \*

The new AC Method removes all oxide coating, soot and carbon. Insulator is clean as new—saving gas, restoring performance.

\*An unretouched photograph.



# You hear it everywhere— "CLEANED SPARK PLUGS SAVE MONEY"

Clean spark plugs stop the waste of 1 gallon of gas in 10! The oxide coating which forms on all plugs causes intermittent missing (often not noticeable), especially at high speed and on hard pulls. *Every time a plug fails to fire, gasoline is wasted!* But—have your spark plugs thoroughly cleaned by the new AC Method, and the gas waste is stopped—and power and pep are restored.

## DON'T LET OXIDE COATING ROB YOU OF GASOLINE

Get full gasoline economy . . . renew the performance of your car . . . make sure of easier starting . . . by having your spark plugs scientifically cleaned by the new AC Method. If you do it now—you may win a new Ford, Chevrolet, or Plymouth—FREE!

You are entitled to a Free Car Contest Entry Blank when you have your spark plugs cleaned by the new AC Method. The Blank carries full details. *Don't delay!*

## MOST DEALERS, GARAGES and SERVICE STATIONS are equipped with AC SPARK PLUG CLEANERS

All better dealers, garages and service stations have an AC Spark Plug Cleaner and are registered as official spark plug cleaning stations.

## PROMPT AND EFFICIENT SERVICE

AC Cleaning Stations are the most reliable, most efficient organizations in their line of business. They'll clean your spark plugs in a few seconds—only 5 cents a plug.

## PLUGS CLEANED WHILE YOU WAIT

Get Official Entry Blank—YOU may win a new Ford, Chevrolet or Plymouth, FREE!

## Tune in on RAYMOND KNIGHT and his CUCKOOS broadcasting THE AC SPARK PLUG DERBY

A big variety show—and full information on the Free Car Contest. Weekly winners announced. NBC Blue Network . . . every Wednesday evening . . . coast-to-coast.

AC SPARK PLUG COMPANY

Flint, Michigan

St. Catharines, Ontario



# TOM'S TROUBLE

—by Gil



Posed by professional models

## New pounds for skinny figures —quick!

*Thousands gaining 5 to 15 lbs. and husky strength in a few weeks with amazing new double tonic*

DOCTORS for years have prescribed yeast to build up health. But now with this new discovery you can get far greater tonic results than with ordinary yeast—regain health, and in addition put on pounds of firm, good-looking flesh—and in a far shorter time.

Not only are thousands quickly gaining husky, handsome pounds, but also clear, radiant skin, freedom from constipation and indigestion, glorious new pep.

### Concentrated 7 times

This amazing new product, Ironized Yeast, is made from special brewers' ale yeast imported from Europe, the richest yeast known, which by a new process is concentrated 7 times—made 7 times more powerful.

But that is not all! This marvelous, health-building yeast is ironized with 3 special kinds of strengthening iron.

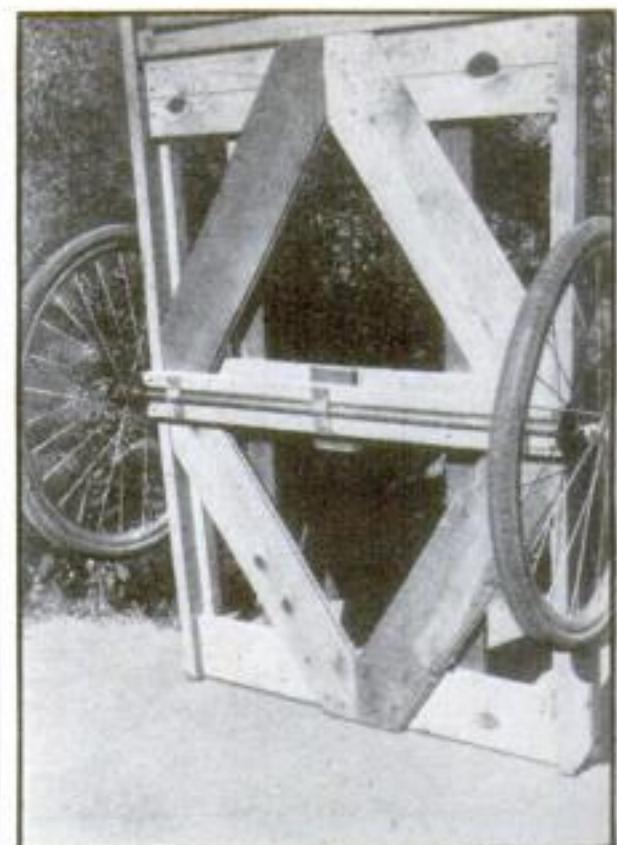
Day after day, as you take Ironized Yeast, watch flat chest develop, skinny limbs round out attractively, new health come.

### Results guaranteed

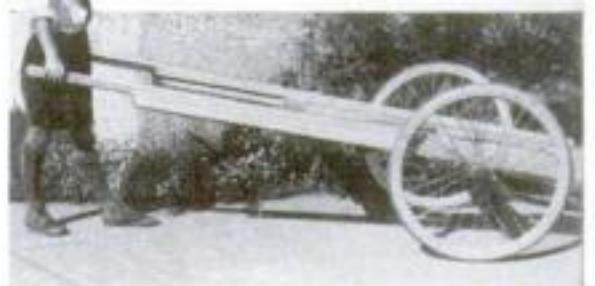
No matter how skinny and weak you may be, this marvelous new Ironized Yeast should build you up in a few short weeks as it has thousands. If you are not delighted with the results of the very first package, your money instantly refunded.

### Special FREE offer!

To start you building up your health right away, we make this absolutely FREE offer. Purchase a package of Ironized Yeast at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body", by an authority. Remember, results are guaranteed with the very first package—or money refunded. At all druggists. Ironized Yeast Co., Dept. 456, Atlanta, Ga.



Underside of the carrier showing how the old bicycle wheels are attached to the frame with 5/8-in. pipe. Below: A boy can handle it



## A BOY'S BOAT BUILT FOR FIVE DOLLARS

(Continued from page 67)

in mind, too, that the wood must be thoroughly dry before any painting is done. Green is an appropriate color when the entire boat is finished in one color. If you wish to show the water line, paint the bottom up to within 6 in. of the top or gunwale with green or red paint, and finish the remainder with two coats of white enamel.

If you live some distance from the shore, a carrier can be made as shown in the photographs above. It is supported on two old rear wheels obtained for 50 cents each at a bicycle shop. Check up on the spokes and tires. Remove the inside of the hubs, but leave the washers, ball bearings, and caps; then mount the wheels on a suitable wooden frame by means of 5/8-in. gas pipe. Slide the punt on the carrier until it is in balance. The carrier will carry safely about 200 lb. It is surprising how little effort is required to move the punt in this way. A 10-year-old boy can wheel it without undue strain.

## USES FOR OLD FELT HAT

A PIECE cut from an old felt hat and tacked to a block of wood can be used for (1) applying filler to close the pores of wood surfaces, (2) as a pad over which sandpaper can be tacked to obtain a smoother sanded surface after applying undercoats in any finishing process, (3) to apply oil to the flat surfaces of shop machinery as a rust preventative, and (4) to apply polishing wax. A disk from the crown of the hat can be cemented to a sanding disk and charged with whiting to form a buffer and polisher.—R. R.



The wall of the pool is built up 18 in. above ground level. Note that the tile parapet is lowered at one end to enable leaves and surface litter to be run off by overflowing if necessary

## SWIMMING POOL BUILT IN BACK YARD

(Continued from page 73)

If possible, locate the pool on high ground. Then it can be drained out into the garden or shrubbery by means of a series of pipes with one or more control valves. Excavate a foot or more wider than the outside dimensions of the walls so there will be room to set up and remove the forms (Fig. 2). Use grade No. 2 lumber, surfaced on one side only, for the forms, with the smooth side next the concrete. Set the 2 by 4 in. uprights about 24 in. apart, and note that *A A* rest on bricks, and that the inner forms are supported by *B B*, which are suspended from the cross timber *C*. The forms are braced by *D*, *E*, and diagonals, as shown.

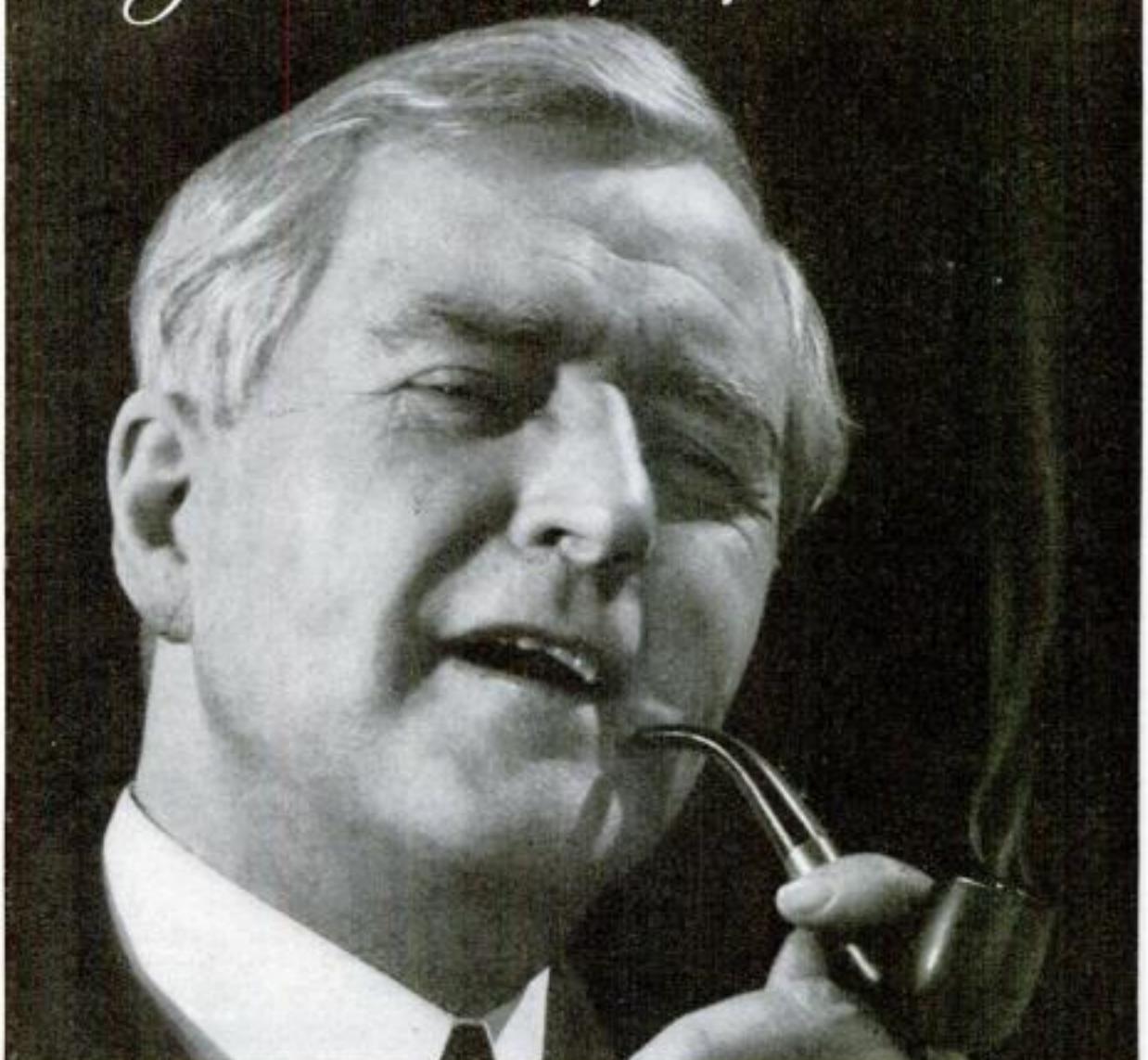
The side walls are poured first, and after they are set and the forms removed, the bottom is poured. Twisted reinforcing bars are used in the walls and also to tie the sidewalk to the walls, as illustrated in Fig. 3. The walls should be from 6 to 8 in. thick over all; the bottom, about 7 in. For a strong concrete, mix dry 1 part Portland cement with 6 of sand and gravel (2½ sand and 3½ gravel), and add the required amount of water. You will save time and expense by renting a small power concrete mixer, or by employing a contractor for a short time, unless ready-mixed concrete can be obtained.

In a day or two the concrete will have set sufficiently to remove the forms, and the bottom can be completed. When 3 or 4 in. of the bottom have been poured, lay on reinforcing screen, about 6-in. mesh, welded No. 10 wire, as in Fig. 4.

Before pouring any concrete at all, however, the drainpipe must be laid as shown in the cutaway view. It should be a 2-in. or larger galvanized pipe with the outlet in a sump, or depression, just below the level of the deeper end. Make a collar with a copper or brass screen so that in case rings or jewels are lost in the pool they will not be carried out in the drain.

Water is supplied through the garden hose in filling the pool. If the pool is on high ground, the waste water can be used to irrigate the garden and shrubbery by a system of pipes with valves conveniently located, or it can be turned into the sewer if the local building regulations are complied with. In level districts it will be necessary to install an electric pump for drainage and distribution. Pumps are (Continued on page 91)

*"Don't bother telling me why I should pay more!"*

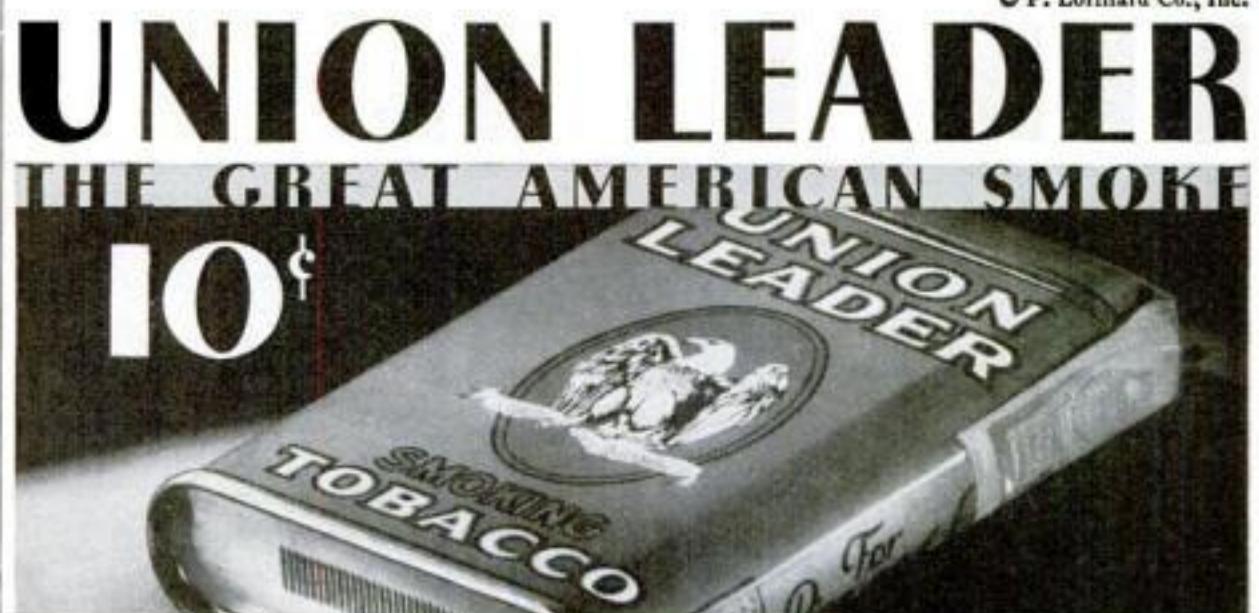


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who want to give their child a better start in life



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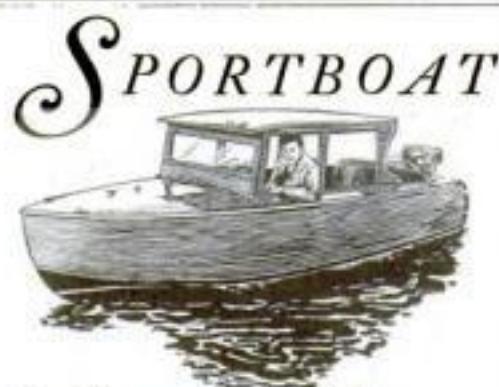
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TO AID you in your home workshop, POPULAR SCIENCE MONTHLY offers blueprints for a number of well-tested projects. The blueprints are 15 by 22 in. and are sold for 25 cents a single sheet (except in a few special cases). Order by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title, it means that there are two or more blueprints in the complete set. If the letter "R" follows a number, it indicates that the blueprint or set of blueprints is accompanied by photographically illustrated instructions which supplement the drawings. If you do not wish this supplement, omit the letter "R" from your order and deduct 25 cents from the price given. The instructions alone are sold for 25 cents each.

Many other blueprints are available. Send a stamped and addressed envelope for a complete list.

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### BOATS

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*Canoe, 16-ft. Canvas Covered Kayak, with sail, etc., 192-193-194-R	1.00
*Duck Boat, Folding, 170-R	.50
*Outboard Racer, 11½-ft., 156 lb., 128-129-R	.50
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Screen-Grid Set, 109	.25
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### SHIP AND COACH MODELS

Construction kits are available for some of these models. See page 92.	
Bark, Scenic Half-Model (13½-in.), 108	.25
Battleship—U. S. S. Texas (3-ft. hull), 197-198-199-200	1.00
Bottle, Clipper Ship in, 121-122	.50
Clipper, Baltimore (8-in.), 92	.25
Clipper Ship (20½-in. hull), 51-52-53-R	1.00
Clipper, Simplified (9½-in. hull), 219	.25
Constitution (21-in. hull), 57-58-59-R	1.00
Cruiser Indianapolis (12 in. long), 216	.25
Destroyer—U. S. S. Preston (31¼-in. hull), 125-126-127-R	1.00
Galleon Revenge (25-in.), 206-207-208-209	1.00
Galleon, Spanish Treasure (24-in.), 46-47	.50
Hartford, Farragut's Flagship (33½-in. hull), special prints 221-222	1.25
Mayflower (17½-in. hull), 83-84-85-R	1.00
Miniature Coach and Covered Wagon for Decorating Boxes, etc., 202-R	.50
Motorboat, 29-in. Cruiser, 63-64-R	.75
Motorboat, Working Model (20-in.), 196	.25
Liner—Manhattan (12 in. long), 204	.25
Pirate Galley or Felucca (20-in.), 44-45-R	.75
Roman Galley (19-in.), 138-139-R	.75
Sails—Square and Fore-and-Aft for Whaler Wanderer or any Model, 185-186	.50
Santa Maria (18-in. hull), 74-75-76-R	1.00
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Viking Ship (20½-in.), 61-62-R	.75
Weather Vane, Ship Model (30-in.), 66	.25
Whaler—Wanderer (20½-in.), 151 to 154	1.00
Yacht Sea Scout (42-in. racing), 106-107-R	.75
Yacht (20-in. racing), 48-R	.50

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Perpetual Star Chart, 214	.25
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Toy Airplane Cockpit with Controls, 114	.25
Toy Birds and Animals, Jig-Sawed, 56	.25
Toy Drill Press, Lathe, Saw, etc., 113	.25
Toy Dump Truck, Fire Engine, etc., 101	.25
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Send me the blueprint, or blueprints, numbered as follows:

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Please print your name and address clearly.

## SWIMMING POOL BUILT IN BACK YARD

(Continued from page 89)

designed and manufactured for this purpose, and the cost of current to drain a pool of ordinary depth will be nominal.

Note that the parapet at the deep end is lowered 2 in. so that leaves and other surface litter can be floated off by overflowing the pool.

The rough concrete surface of the inside of the pool is covered with from  $\frac{1}{4}$  to  $\frac{1}{2}$  in. of Portland cement and clean sifted sand, about 1 part to 5 (Fig. 3). The corners should be rounded with a trowel so that the pool will be easy to clean. When the smooth course of cement has set, but before it is dry, paint over with two coats of waterproof cement. This is applied with a kalsomine brush, and consists merely of waterproof cement and water mixed to a thick gravylike consistency. It will make the interior of the pool quite smooth.

In the original pool, 9-in. glazed brown tile was laid around the top of the parapet. This feature, however, can be dispensed with.

The steps or ladder for climbing out of the pool should be made removable, as in Fig. 5, so that the walls can be cleaned back of it. It is secured to the wall by two bolts through two pairs of eyebolts embedded in the concrete.

In warm weather ordinary city water will soon become green with algae if left standing. To keep this down and also to sterilize the water, it should be treated with copper sulphate or "bluestone" just as is done in public swimming pools. For your own use, tie about a pound of the crystals in a muslin or strong gauze bag, and with a long pole swish it through the water each morning—just enough to give a light blue tint. Too strong a solution will cause eyes to smart and impart a green tone to blond hair, and likewise will be detrimental to the plants upon which it is drained. Be careful, therefore, to make the daily application lightly rather than give an extra strong dose about once a week.

## CANDY PAIL KEEPS HOSE FROM GETTING KINKED

IF YOU have no garden hose reel, a simple and most inexpensive method of keeping the hose in good condition is to hang it on an ordinary wooden candy pail as shown. A strip of wood is nailed to the bottom of the pail so that the whole can be hung on a large nail or screw. When placing the hose over the pail, take care that the lower part of the coil does not touch the floor.

A garden hose, when not in use, should never hang over brackets or any sharp objects, as this will put kinks in it and finally cause a break at these points; neither should it be left lying on the floor or ground for any length of time.—H. B.

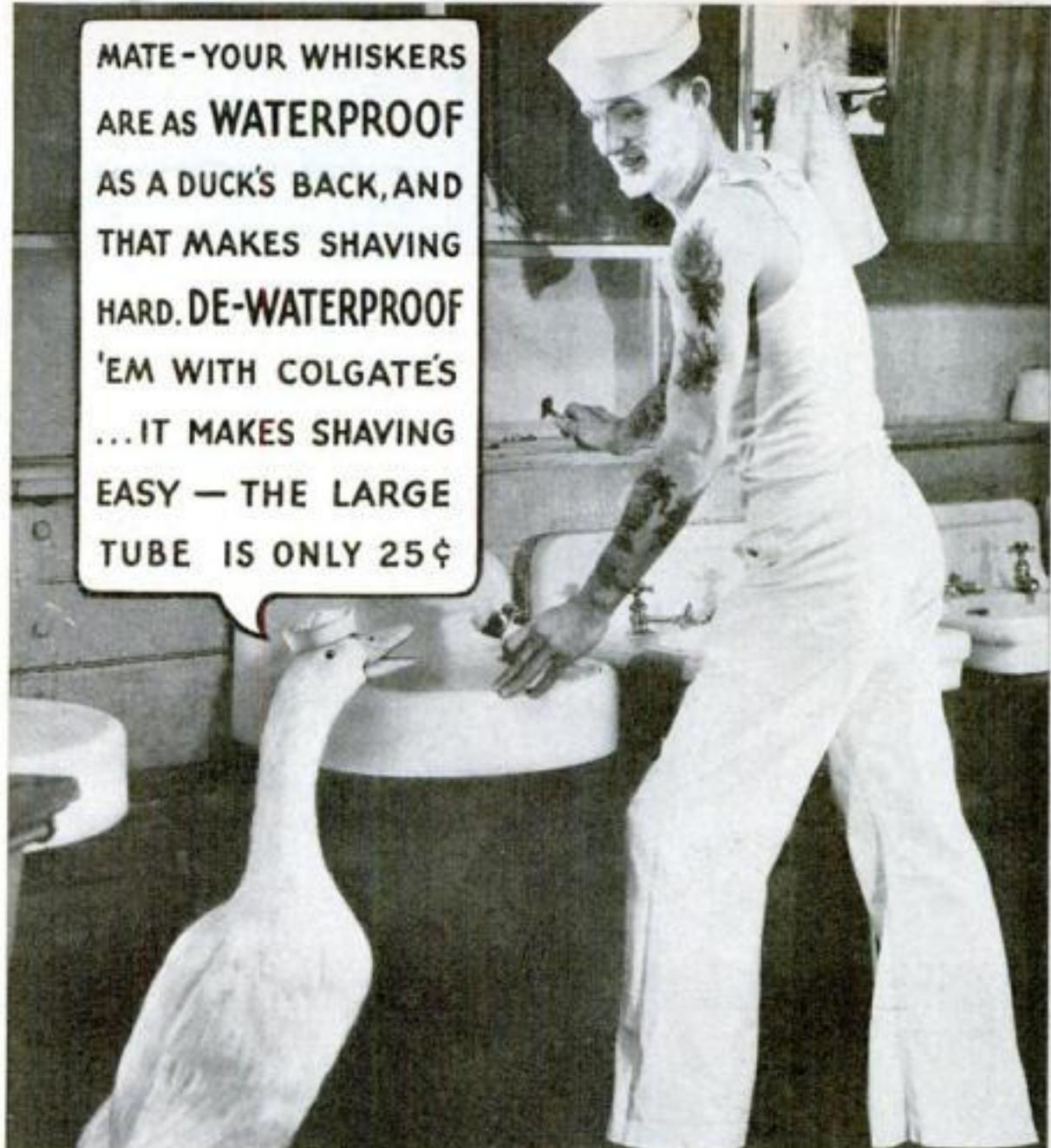
## REFINISHING RUSTY HARDWARE

RUSTY door knobs, hinges, and other hardware can be improved in appearance and preserved by coating them with brushing lacquer to match their original color.—D. H.



Garden hose hung on an empty candy pail

MATE-YOUR WHISKERS  
ARE AS WATERPROOF  
AS A DUCK'S BACK, AND  
THAT MAKES SHAVING  
HARD. DE-WATERPROOF  
'EM WITH COLGATE'S  
... IT MAKES SHAVING  
EASY — THE LARGE  
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Every whisker that darkens your chin is encased in a tough, waterproof coating of oil—and that oil coating is what makes your whiskers so hard to cut.

Once you remove that waterproofing—remove every trace of it from every whisker—your razor will cut smoothly—without scrape, without pull.



But—that's where many shaving creams fall down on the job. They don't, can't remove all that waterproofing. For most shaving creams whip into big-bubble lather—and you can't get a lot of big bubbles close to anything so small as a whisker.



But—Colgate's Shave Cream lathers up into millions of tiny, small bubbles. Thousands of these little bubbles swarm around every single whisker—crowd close to it. These tiny bubbles attack every whisker—strip away every trace of waterproofing. They emulsify the oil—float it away.



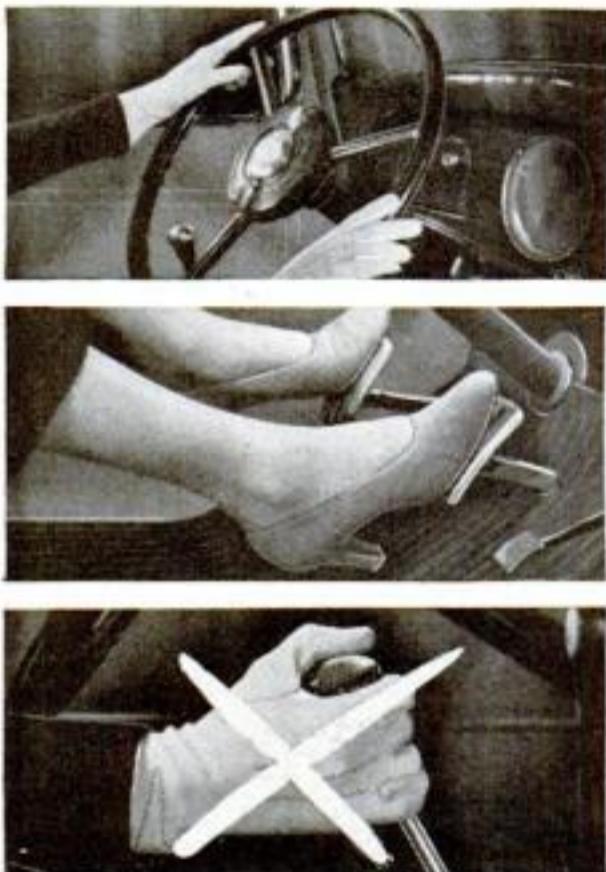
Then they soak each whisker soft. And your razor cuts like a knife through cheese! Try Colgate's... see how its small-bubble lather makes shaving easier. Buy Colgate's today—the large 35¢ tube is now only 25¢.

P.S.—For a grand finish to a great shave, try Colgate's After-Shave Lotion and Colgate's Talc for Men.



De-waterproof your whiskers, and make shaving easier.

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## Construction Kits WILL SAVE YOUR TIME



The historic *Hartford*—KIT L

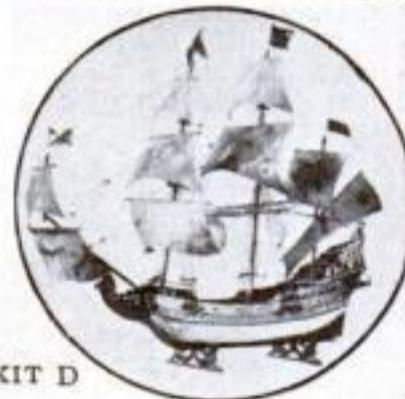


YOU cannot get the most out of life these days without having a hobby. And of all hobbies, none will give you greater satisfaction year in and year out than making things in your home workshop—even if the only bench you have is the kitchen table. "Oh, I can't make anything on the kitchen table," you may say.

That is not the case if you make use of our construction kits. They have been designed especially for beginners and for those with limited equipment and tools.

One great advantage of the kits is that they provide in a single package all the materials necessary to make any one of a number of ship models and pieces of furniture. Second, the materials are in such a form that they save you a vast amount of tedious and relatively uninteresting work. Third, they are inexpensive. Fourth, the materials are of the finest quality. Fifth, there is no waste, and you do not have to buy a larger quantity of anything than is actually required.

A variety of ship model construction kits are available, ranging from such small and simple models as the *Manhattan* and the *Indianapolis* to the large and impressive model



KIT D



KIT F

of Farragut's flagship, the sloop-of-war *Hartford*, which is 41 in. long over all.

The ship model kits contain only the raw materials, although in several of them a certain amount of preliminary shaping has been done on the hulls. In our furniture kits, however, the turning, boring, and other machine operations have been completed. All that remains to be done is the necessary hand finishing and assembling.

All kits are accompanied by instructions or blueprints. The list continues on the following page.

**A.** Whaling Ship model *Wanderer*. All the raw materials (except paints), Blueprints Nos. 151 to 154, and a booklet. The hull is 20 $\frac{1}{2}$  in. long.....\$6.90

**AA.** Same with hull lifts sawed.... 7.40

**D.** Spanish galleon ship model, 24 in. long. All the raw materials (except paints), Blueprints Nos. 46 and 47, and a booklet 6.45

**DD.** Same with hull blocks shaped.. 6.95

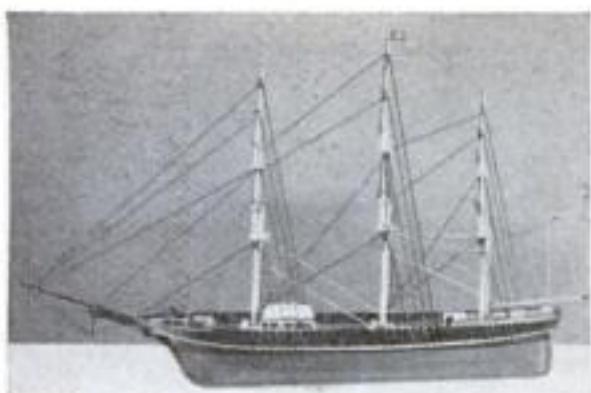
**E.** Battleship model, U.S.S. *Texas*, 3 ft. long. All the raw materials (except paints) and Blueprints Nos. 197 to 200..... 6.95

**EE.** Same with hull lifts sawed.... 7.45

# POSITIONS . . . PROMOTIONS

*seek the man who is*  
**READY!**

**"That man has real  
ideas . . . We need him!"**



KIT J

Materials for a miniature clipper ship



KIT A



F. Liner *Manhattan*. All raw materials (except paints) for a simplified miniature model 12 in. long, and Blueprint No. 204. 1.00

G. Elizabethan galleon *Revenge*. All raw materials (except paints) for a model 25 in. long, and Blueprints Nos. 206 to 209. 6.75

GG. Same with hull blocks shaped. 7.25

H. Cruiser U. S. S. *Indianapolis*. All raw materials (with enamels) for a simplified 12-in. model, and Blueprint No. 216. 1.50

J. Clipper ship *Sea Witch*. All raw materials (except paints) for a simplified 13-in. model, with blueprint. 1.50

L. Farragut's flagship *Hartford*, a steam-and-sail sloop-of-war. All raw materials (except paints) and special Blueprints Nos. 221 and 222. The hull is 33½ in. long, and the over-all length is 41 in. 7.95

LL. Same with hull lifts sawed. 8.45

No. 2. Solid mahogany tray-top table 23 in. high with a 15 in. diameter top. Ready to assemble, but without finishes. 5.40

No. 4. Solid mahogany book trough 22½ in. long, 9½ in. wide, and 24¾ in. high over all. Ready to assemble, with finishes. 5.30

No. 5. Solid rock maple hanging wall rack with one drawer, 19½ in. wide, 33¾ in. high. Ready to assemble and stain included. 5.75

No. 6. Solid rock maple butterfly table, top 19 by 22 in., height 22½ in. Ready to assemble and stain included. 6.90

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Please send me Kit ..... for  
which I inclose \$ ..... (or send C. O. D. )

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Address .....  
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Note: Prices of all kits except F, H, and J are 50 cents higher west of the Mississippi River because of heavy shipping charges. We prepay the postage on both cash orders and C. O. D. orders, but if you order C. O. D. you will have to pay on delivery the extra charges made by the Post Office, which amount to 28 cents. Kits F, H, and J cannot be sent C. O. D. This offer is made only in the United States.



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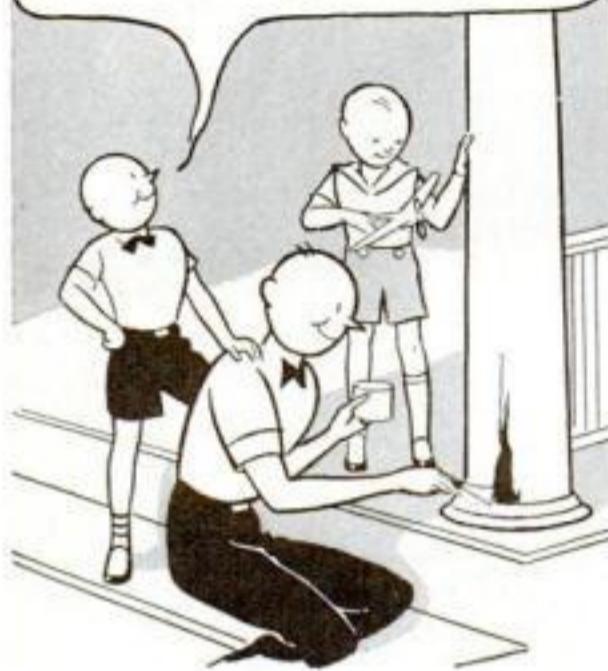
1. I enclose 10 cents for Royal's Simple System of Touch Typewriting.

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MY DAD CAN  
FIX ANYTHING  
WITH PLASTIC WOOD



## WOOD IN CANS

### Makes 1001 Household Repairs Quickly, Easily, Permanently

Resets loose drawer pulls	Fills old nail, screw holes
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Anyone can become an expert handy man with a can of this greatest of all scientific discoveries—Plastic Wood. It handles easy as putty—can be shaped, molded or stuffed into cracks—but when it dries it becomes actual wood—wood that takes nails or screws without splitting—wood that can be carved, sanded, planed—wood that can be painted, varnished, shellacked or lacquered—in fact it can be handled or treated just like real wood.

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Thousands of craftsmen always keep a can of Plastic Wood right on the workbench—all the time. They know it can be used to save time and labor on 9 out of 10 jobs to repair wood—to hide dents, blemishes, splinters, tool-marks, streaks, knotholes, and correct mistakes.

Get a 25c tube or 35c can at any hardware, paint, department store and prove to yourself how marvelous it is.



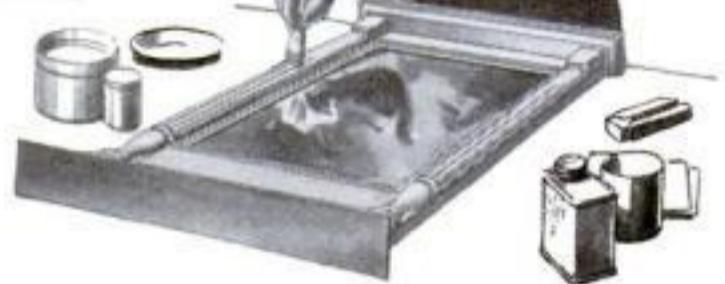
PLASTIC WOOD

# Mirror Frame

## ORNAMENTED WITH TURNED COLUMNS

By Herman Hjorth

Author of *Basic Woodworking Processes*  
and *Principles of Woodworking*



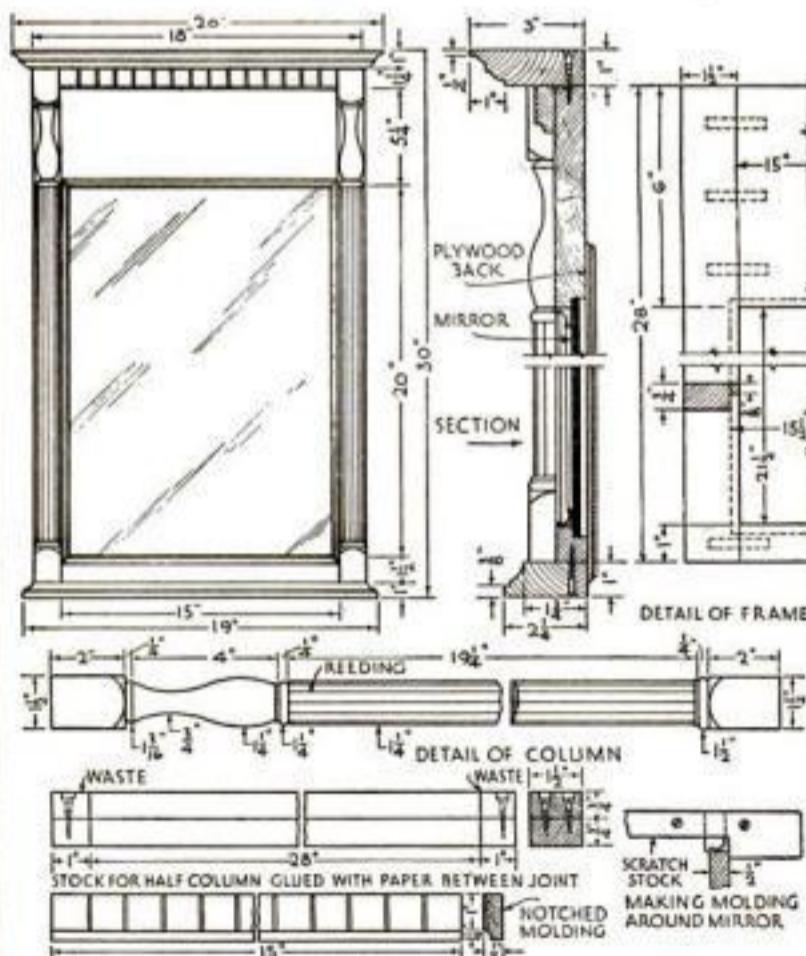
THE first glass mirrors were made in Venice, Italy, about 1300 A. D. They were very small, poor, and so expensive that only the well-to-do could afford them. Because of their cost, they were placed in elaborately carved and gilded frames. In our day these conditions have been reversed. Mirrors are now so cheap that the frame is often the more expensive part.

While mirrors are primarily useful articles of furniture, they also play an important part in the decorative scheme of any room, whether a hall, a living room, or a bedroom, if they are suitably and attractively framed.

The mirror illustrated is not difficult to make. It is designed in such a way that it can be made narrower or longer to fit whatever size glass is available or to suit a particular wall space.

Begin by making the plain frame. This consists of four pieces, two horizontal ones called "rails" and two vertical ones known as "stiles." These are joined with dowels as shown. The rabbets for the glass can easily be cut on a small circular saw or a shaper. If power tools are not available, the rabbets on the rails can be planed with an ordinary rabbet plane, but those on the stiles, which are stopped on both ends, must be worked out with a chisel and a router plane.

After the frame is glued together, the small molding that is fastened to the rabbeted edges



Front view of the complete mirror, a cross section drawn on a larger scale, and details of frame, half columns, and moldings

is made from 1/2-in. stock as shown on one of the detail drawings. A scratch stock may be used for shaping it; this is a homemade tool consisting of a piece of hardwood and a cutter made from a broken saw blade filed to the desired shape. The pieces of molding are then ripped to thickness, mitered, and glued to the frame. If the mirror is temporarily placed in the rabbet, it is easier to glue the molding. Hold the molding in place with fine brads until the glue is dry, after which the brads are withdrawn.

The more experienced craftsman will probably want to cut the molding directly on the rails and stiles. In this case the pieces should be made 1/2 in. wider than shown. This really is the better way, but not as easy as the one described because the dowel and miter joints are more difficult to make.

The pieces for the two half columns are glued together with a piece of paper between the joint as shown on the detail drawing. Make the pieces a little longer and screw them together at the ends as an added precaution. The pieces are turned as one solid piece in the usual way. Avoid chipping the square parts when rounding off the column. (See the article on spiral turning, P.S.M., May '34, p. 76.)

The column may be reeded as follows: Wrap a strip of paper around it to get the exact length of its circumference. Divide this paper strip into an even number of parts, say twelve. Wrap it around the column again so that two of the division marks are in line with the glued joint. Mark the other divisions on the column with a pencil. Now make a box, such as would be needed for shipping the column, and mount the column on two screws passing through the ends of the box. (See drawing, P.S.M., Mar. '34, p. 104.) Make a scratch stock as shown, and scratch a reed at every division mark, holding the column steady by wedging it in the box. Do not scratch any reeds along the glued joint.

Saw the column to length and split it by inserting a chisel in the joint at one end. The wedge action of the chisel causes the paper to split so that the two half

columns are easily separated. Clean off the remaining glue and paper on the back of each half column, and glue them in place as shown.

The notches in the molding between the upper ends of the column are best made with a chisel in the form of V-cuts. The top and base moldings may be made of one solid piece of wood as shown, or they may each be built up of two pieces. They may be made by machine or by hand, or they may be bought ready-made from a concern specializing in such materials.

A mirror frame of this kind should be made of some close-grained cabinet wood such as mahogany, walnut, maple, birch, or gum. It should preferably be stained with water

### List of Materials

No. of Pieces	Description	T.	W.	L.
2	Stiles	$\frac{3}{4}$	$1\frac{1}{2}$	28
1	Rail	$\frac{3}{4}$	1	15
1	Rail	$\frac{3}{4}$	6	15
2	Half columns	$\frac{3}{4}$	$1\frac{1}{2}$	28
1	Notched molding	$\frac{1}{2}$	$1\frac{1}{4}$	15
1	Molding	$\frac{3}{8}$	$\frac{1}{2}$	76
1	Top molding	1	3	20
1	Base molding	1	$2\frac{1}{4}$	19
1	Mirror	$15\frac{3}{8}$	$21\frac{3}{8}$	

NOTE: All dimensions are in inches and are finished sizes.

stain, because this gives a clear color that does not fade and is not dissolved by succeeding coats.

It may be filled with a paste wood filler or by one or two coats of very thin shellac. A lump of wood filler is dissolved in benzine to the consistency of cream and then brushed liberally on the wood. When it turns flat, it is wiped off across the grain with a piece of burlap so that the filler is forced into the pores. The surplus is then removed with a soft cloth. Corners may have to be cleaned out with a pointed wooden stick. After drying twenty-four hours, the frame is given a coat of shellac, which should be as thin as water. After a couple of hours this may be rubbed down with No. 2/0 or 3/0 steel wool.

The surface may now be finished with two more coats of thin shellac or with two or three coats of varnish. If varnish is used, it should be a cabinet rubbing varnish, which dries in from eighteen to twenty-four hours. It should be applied as it comes from the can in a warm and dust-free room. It is well to rub the frame with a cloth moistened in turpentine before applying the varnish. Be sure to clean the brush well in turpentine before beginning the work, and do not shake the varnish can, because this causes the formation of air bubbles, which are very hard to brush out. Rub the first coat of varnish lightly with steel wool before applying the next.

The last coat of varnish should be rubbed with grade FF powdered pumice stone and water. Use a felt rubbing pad on the flat surfaces and a wood finisher's rubbing brush, if available, or an old, stubby brush on the turned parts. Clean off the surfaces with a chamois skin and finish with a soft cloth and polishing oil.

*This is the ninth of a series of simple woodworking articles by Mr. Hjorth. Suggestions for the subjects of future articles will be welcomed from readers.*

### CUPS FOR MIXING GLUE

DURING the summer make it a habit to save the paraffined paper cups in which ice cream is commonly sold for a nickel. They are handy for mixing casein glue and other liquids and pastes used in the workshop, and can be burned after use without the trouble of washing.—R. R. A.



# —but she can't live on a mere pedestal

American men have long enjoyed the reputation of being devoted husbands. But any wife, and especially a mother of growing children, needs more substantial support than a pedestal of adoration.

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# "Son, YOU CAN'T GO WRONG WITH A Remington"



—and that goes for the ammunition as well as the gun!"

JACK HOLT, famous star of Columbia Pictures, knows that good marksmanship depends largely on the right rifle and the right ammunition! In training his son, Tim, to hold steady and hit 'em, he insists on a Remington .22 and Kleanbore cartridges.

The Remington Jack Holt shoots is a beautifully balanced bolt-action repeater with American walnut stock, chromium-plated bolt, bolt handle and trigger; and adjustable rear sight. And it shoots .22 short, long and long rifle cartridges where you aim! The model number is 34.

Why does Jack Holt recommend Kleanbore ammunition? Because Kleanbore banishes leading, pitting and rusting. It keeps your gun in perfect condition. No cleaning at all! And a clean gun is an accurate gun.

Take Jack Holt's advice . . . get yourself a Remington, shoot Kleanbore cartridges, and be a better marksman. You can see these fine guns at your local Remington dealer's. Or write to us for Folder No. 18. Remington Arms Co., Inc., Bridgeport, Conn.

**WAS \$17.55**

**NOW ONLY \$12.50**

Model 34  
Repeater



**KLEANBORE**  
AMMUNITION

## UNUSUAL VARIETY OF CRAFTWORK EXHIBITED

The quality, variety and number of projects shown at recent exhibitions of home workshop clubs was a revelation to the thousands of visitors. These are four unusual examples from the Rockford Homecraft Club



## HOME WORKSHOP CLUBS DISPLAY SKILL IN EXHIBITIONS

*(Continued from page 71)*

munity, but is also very likely to attract new members. For this reason the Guild urges every new club now being organized—and all the older clubs that have not already done so—to plan an exhibition for next fall or winter.

A little ingenuity in announcing an exhibition will aid in obtaining entries and in inducing visitors to attend. A clever example of how this can be done without expensive printing is illustrated on page 98. That announcement was sent out by the Home-workshop Club of Cleveland, Ohio, of which T. B. Owens is president and P. B. Howard, secretary. It was hand-drawn and lettered in three colors, then copied by means of a gelatine duplicator or hectograph.

A successful exhibition was held by the Fairfield Hobby Club of Fairfield, Ala., only a few weeks after it had been organized. The exhibits ranged from a living-room chair to a pair of book ends, and included magazine racks, candlesticks, desks, tables, and wall racks. This club has a shop with one 36-in. and one 48-in. wood-turning lathe, a 14-in. band saw, a small rip and cutoff saw, a jigsaw, a large drill press, and several motors. A shaper and a jointer are to be purchased, and other equipment will be added from time to time. The officers of the club are Roy B. McEachern, president; Garland T. Wilson, vice president; T. S. Smith, secretary; Wiley Stuart, treasurer; and C. N. Jones, librarian.

The 1934 annual exhibition of the Rockford Homecraft Club had an attendance of almost 3,000. There were about 100 exhibits covering a remarkably wide range of craft-work. Besides furniture, machine tools, models, and other more or less standard projects, there were several exhibits of an unusual

type. One was a hand-carved copy made by a physician of a German house altar which he had seen in Germany during the World War. This required nearly two years to complete. L. B. Achor, treasurer of the Guild, who is by profession a banker and has no mechanical training, exhibited a steam-driven locomotive model. A woman member of the club entered a group of extraordinarily realistic artificial flowers.

Excellent craftwork of many varieties was displayed at the spring exhibition of the Dixon Homeworkshop Club, Dixon, Ill. One of the most impressive pieces was a bird house built in the form of a large, ornate model of a stone castle, complete even to the weather vane.

One of the largest of the new clubs is the Nutmeg Homeworkshop Club of New Britain, Conn. It was organized with forty-seven members. The officers are George Broadhurst, president; Fred J. Gross, vice president; Frank S. Lecrenier, secretary; John B. Freysinger, treasurer; Robert B. Skinner, librarian; and John W. Lockett, publicity director.

Thirty-four members were present at the third meeting of the Jacksonville Homeworkshop Club of Jacksonville, Fla. Demonstrations of faceplate turning and metal spinning were given by instructors from the Jacksonville schools. Plans were made for holding the spring exhibition of members' work in a local store which was willing to donate the necessary space.

A. P. Meredith, secretary of the Jacksonville Club, makes a practice of sending out neat mimeographed announcements that are enlivened by amusing sketches. One in particular was

*(Continued on page 97)*

## HOME WORKSHOP CLUBS DISPLAY SKILL

(Continued from page 96)

illustrated by a comic drawing of a man with a hammer looking at his shop from the outside. He had just nailed a huge board across the door. The accompanying announcement was as follows: "Suggestion No. 96871 for a Large Evening. Materials required—One large board, one large hammer, one large nail. Instructions—(A) Write (or paint) 'March 2nd, 8 P.M., at Hubbard's' on large board.

### More Clubs Join the Guild

The official list of new clubs that have become affiliated with the National Homeworkshop Guild since the May issue of POPULAR SCIENCE MONTHLY was published is as follows:

Brookhaven Home Craft Club, Brookhaven, Miss.

East Norton Homeworkshop Club, East Norton, Mass.

Galesburg Homeworkshop Club, Galesburg, Ill.

Hornell Homeworkshop Club, Hornell, N. Y.

Kraftsmen's Homeworkshop Klub, Fort Dodge, Iowa

Mobile Homeworkshop Club, Mobile, Ala.

Nutmeg Homeworkshop Club, New Britain, Conn.

Oklahoma City Homeworkshop Club, Oklahoma City, Okla.

Orange Homeworkshop Club, Orange, Mass.

Roseburg Homeworkshop Club, Roseburg, Ore.

Saginaw Homeworkshop Club, Saginaw, Mich.

Scranton Homeworkshop Club, Scranton, Pa.

Tulsa Homecraft Club, Tulsa, Okla.

Wethersfield Homeworkshop Club, Wethersfield, Conn.

Zanesville Homeworkshop Club, Zanesville, Ohio

These clubs are in addition to those listed in previous issues of POPULAR SCIENCE MONTHLY. All new clubs will be announced in these columns as soon as possible after their organization. POPULAR SCIENCE MONTHLY publishes all official news of Guild headquarters and the various local clubs.

(B) Use large hammer to drive large nail through large board, fastening same on workshop door. (C) This will remind you this is the night you are to tear yourself away from that sanctum sanctorum known as your workshop." It would be difficult for any member to ignore so novel and amusing a notice as this.

A group of professional and business men form the nucleus of the Lansdale Craftsman Club of Lansdale, Pa. The superintendent of schools gave the club permission to use the school shop one night a week. Among the projects now being made by members are two Welsh dressers, a fernery, a fireside bench, pier cabinets, coffee tables, a Governor Winthrop desk, footstools, and bookcases. The membership

(Continued on page 98)

### Club News Wanted

What is your club doing? Whenever you have an especially interesting program or develop any unusual projects, send a report promptly to E. Raymond DeLong, secretary of the National Homeworkshop Guild, 312 Harper Avenue, Rockford, Ill., or the Guild Editor of this magazine.



Carborundum Brand Lawn Mower Sharpener No. 41 for mowers up to 16 inches wide . . . . . 50c.  
Carborundum Brand Lawn Mower Sharpener No. 42 for mowers 16 inches wide and over . . . . . 65c.

HERE is the lawn mower sharpener you have always wanted. It pays for itself many times over. And it is about the simplest appliance to use you ever saw. No tools; no removal of wheels or reversal of gears; just your two hands—and two minutes.

You step on the handle to raise wheels free from ground; hook sharpener over cross bar; hold it against blades; turn the wheels. The blades revolve against the sharpener—and that's all there is to it. Your mower is ready to go. You save time, money and energy.

### At last . . . a simple, practical scissors sharpener

Anyone can use this sharpener and put a perfect edge on a pair of scissors. A wing on each side of a fast cutting Carborundum Brand Stone, supports the scissors blades and keeps them at exactly the right bevel. A few quick strokes and you have a pair of sharp scissors. What could be simpler?



Carborundum Brand Scissors Sharpener No. 9, at your hardware dealer's, 25c.

Try this new electric match . . . Always ready—lasts a lifetime



At your hardware dealer's. Complete . . . . 50c.

### GLOBAR\* ELECTRIC MATCH

Just plug this new "Globar" Electric Match into any convenient outlet—near your reading lamp, bridge table, office desk—and you always have handy a quick, efficient cigarette, cigar or pipe lighter. One that never gets out of order, never gets lost, and never needs filling. A splendid gift.

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# HOT NEWS

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**No. 1 U.S. GOLDEN FLASH BIKE** Every month we give away four magnificent prizes to the boy or girl who writes the best story on the subject, "My Adventure on a Bicycle," or the one "Best story Illustrating the Value of a Bicycle." In addition to the prizes given away, the prize-winning story will be printed, with the winner's picture, in *Open Road for Boys and Boys' Life*.

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**No. 3 Electric Horn** Write your story and send it in with the coupon below, properly filled out. You can try as often as you like. If your story doesn't win the first month, write another and try again.

**No. 4 Electric Headlight**

### Read These Rules and Start NOW

Anyone under 18 years of age eligible. Manuscripts must be less than 300 words, written in ink or typewriter, on one side of paper only. Mail story with coupon below or copy of one properly filled out to address thereon.

Each story must be a true experience of the writer or some one he knows. Literary ability not necessary, as stories are judged for interest only. Last date to mail letters this month, June 30.

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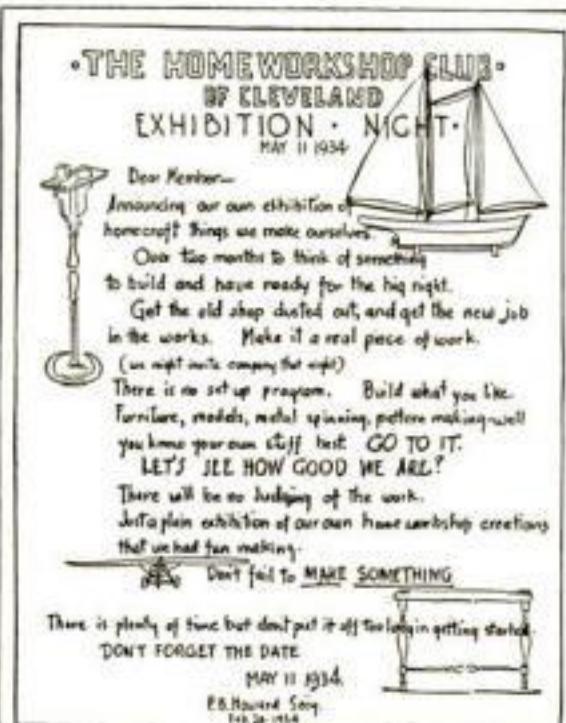
P. S. NO. 3

### HOME WORKSHOP CLUBS DISPLAY SKILL

(Continued from page 97)

includes the following occupations: banker, physician, dentist, academic teacher, dairyman, artist, and jeweler.

O. J. Goering, reports that several of the members of this club are buying power tools similar to those used in the school shop or from catalogs in the club library. The club is particularly fortunate in respect to its library because it has the use of a collection of home workshop literature which Mr. Goering has been making for years. He has several hundred drawings of woodworking projects, a four-drawer filing cabinet full of clippings and blueprints, and bound volumes of *POPULAR SCIENCE MONTHLY* from 1927 to date, as well as other bound magazines and books. Although Lansdale is a town of little more than 8,000, there are at least eight completely motorized home workshops—that is,



Announcement of an exhibition drawn and lettered in three colors and then hectographed

shops with full woodworking equipment.

The Norwood Homeworkshop Club of Norwood, Ohio, is another organization that found the display of handicraft in its first annual exhibition aroused considerable community interest in its activities.

At a meeting of the Homeworkshop Club, Cleveland, Ohio, a demonstration was given by a representative of a company that manufactures a special model maker's lathe, drill press, and hand shaper. Work was actually done on some castings for a small steam engine. This club has been busy arranging for a spring exhibition. At every meeting the members have demonstrated their enthusiasm and have benefited by demonstrations given by expert craftsmen from various machine tool manufacturers.

The Cayuga Craftsman Club, which is the name finally adopted by the club organized in Ithaca, N. Y., has been granted the use of a meeting room at the Y.M.C.A. It also has had the facilities of the woodworking department of the Ithaca High School turned over to it for use on meeting nights. Demonstrations will be given every other week by expert craftsmen. Dick Hutchinson, a well-known craftsman and a frequent contributor to *POPULAR SCIENCE MONTHLY*, is president of the club, and W. H. Elwood, the secretary.

Starting with a charter membership of twenty-four, the Marshalltown Homeworkshop Club of Marshalltown, Iowa, has a prospective membership of from sixty to seventy-five. It is progressing with plans for acquiring and outfitting a club workshop. A few essential

(Continued on page 100)

# SEND FOR SAMPLE!

You can never appreciate the convenience and value of Drybak Band-Aid until you try it. Send 5¢ in coin for sample packet. Use one next time you have a small cut, burn, blister or skin eruption. You will see how easy wound dressing can be.



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New Brunswick, New Jersey

SEND THIS COUPON

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Dept. 245, New Brunswick, N. J.

I enclose 5¢ in coin for introductory packet of Drybak Band-Aid and the outline "First Steps to First Aid".

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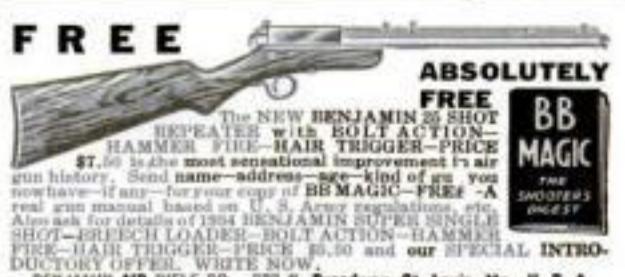
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## Motor-Driven Shop Tools

New 1934 line of "Delta" Quality Tools includes improved motor-driven Jointers, Band Saws, Circular Saws, Lathes, Drill Press, Moulding Cutters, Scroll Saws, and Boring, Routing, Mortising, Sanding Attachments, and complete line of accessories—all at new low price levels. Send TODAY for FREE illustrated 56-page Catalog, and details of 10-Day Trial Offer and Easy Payment Plans. No obligations.

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[6-34]

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When the books arrive I will pay the postman \$1.00 for each book delivered plus a few cents postage. You are to refund what I have paid if I return the books within five days of their receipt.

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The Super-X long range .22 cartridge adds new thrills to pest and small game shooting. Instead of merely hitting your mark the bullet CRASHES into it, at nearly double the effective range of ordinary .22's.

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- 4 Bullet Expands After Striking
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## New 9"x3' South Bend Lathe

This new "WORKSHOP" LATHE is a Back-Geared Screw Cutting Metal Working Lathe with automatic longitudinal feed, graduated compound rest, hollow spindle. Cuts screw threads 4 to 40 per in. Operates from lamp socket. Price with motor, switch and belting, complete \$95. Write for Circular 5-W



**SOUTH BEND LATHE WORKS** NRA  
847 E. Madison St. South Bend, Ind.

## HOME WORKSHOP CLUBS DISPLAY SKILL

(Continued from page 08)

machines will probably be purchased in the beginning, and other equipment will be built as shop projects.

To carry out the recommendations of the Guild in respect to community projects, the Norwood Homeworkshop Club of Norwood, Ohio, has passed a resolution to the effect that the members of the club pledge their support to the Boy Scouts of Norwood in their efforts to aid the needy.

The membership of the Peekskill Homeworkshop, Peekskill, N. Y., is quite varied. The occupations represented include the following: merchant, molder, chemist, student, doctor, and printer.

The name "Queen City Homeworkshop Club" has been chosen by the organizers of the Elmira, N. Y., club because Elmira is named the "Queen City" of the Southern Tier. One of the new club members is the managing editor of the Elmira Star-Gazette.

Not a city, but an oil field is the home of the Craftsman's Homeworkshop Club of St. Louis, Okla. It was organized with eleven members in the heart of an oil field.

At a recent meeting of the Fargo Homeworkshop Club of Fargo, N. D., the forty-five members and guests listened to an address by H. W. Weltzin, a manual training teacher of the Moorhead State Teachers College.

The Denison Homeworkshop Club of Denison, Iowa, is another of the clubs that is holding meetings in the manual training room of a public school.

The organization meeting of the Scranton Homeworkshop Club of Scranton, Pa., was held in the Chamber of Commerce Building, and the club is continuing to meet there. Among those who have addressed the club are Prof. L. C. Smith, of the Technical High School, and P. J. Dowdell, who is organizing leisure-time programs in connection with the Scranton Recreation Bureau.

## HOW TO START A HOME WORKSHOP CLUB

IF THERE is no local club affiliated with the National Homeworkshop Guild in your home community, you should seize the opportunity to start one at once.

The Guild offers to all amateur craftsmen the opportunity of enjoying real co-operation and companionship in their hobbies. It is the first time this opportunity has existed in the home workshop field. The purpose of the Guild is solely to promote handicraft of all types. It has nothing to sell and is entirely noncommercial. Its national officers and directors are serving without pay, and it is sponsored by an advisory council of men of national prominence.

Complete information is available for the asking on how to organize a club. You can obtain it by filling out the coupon below. Please inclose with it a large self-addressed and stamped envelope.

National Homeworkshop Guild  
c/o Popular Science Monthly  
381 Fourth Avenue, New York, N. Y.

I am interested in the home workshop club idea and wish to know what the National Homeworkshop Guild will do for me. Please send me this information in the large self-addressed and stamped envelope I am inclosing.

Name.....

Address.....

City..... State.....

(Please print very clearly)

## WORLD WIDE ALL WAVE RADIO



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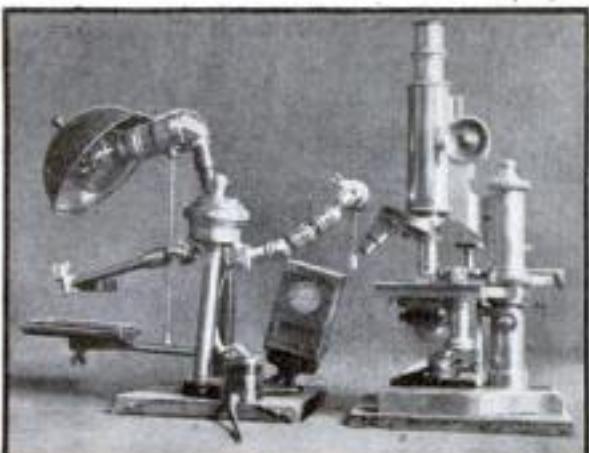
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## MICROSCOPE UNIT FOR ADVANCED WORKERS



The auxiliary unit, made from odds and ends, contains a number of microscope accessories

THIS unit was designed for the microscopist who has advanced to a point where his accessories must have a wide range of adaptability, yet be compact and convenient. It is an elaboration of the four-in-one outfit for beginners described in a previous issue (P.S.M., July '33, p. 60).

The post supporting the magnifying glass and overstage light can be so adjusted that a small, powerful bull's-eye light beam can be trained on the stage, thus giving light suitable for opaque slides without the use of an expensive dark-field or vertical illuminator. Some workers like to vary the light intensity for certain kinds of observations in order to eliminate glare. This can be accomplished by connecting a carbon-pile resistance in the electric circuit. Other workers prefer to use 6-volt lamps because of their concentrated filaments. This can be done by using a small bell-ringing transformer and connecting the resistance on the 6-volt side of the transformer.

Another suggestion is to make the dissecting turntable frame interchangeable with a piece of ground glass. This should prove advantageous when preparing transparent slides. The small, flexible ball-joint lamp can be adjusted under the turntable to illuminate the slide from beneath. Color filters described in a previous issue (P.S.M., Aug. '33, p. 83) can be used to advantage in preparing the slides.

The light schemes described are intended for biology and botany students as well as those who use the microscope for a hobby on 700-X power or less. Microscopists intending to use high-power oil-immersion objectives will have to employ the more scientific apparatus available because of the very short focal length of these objectives.—OSCAR FREEMAN.



Combination dissecting turntable with magnifier, and overstage and understage lamps

### HEATPROOF GRIP FOR PLIERS

WHEN gas pliers are to be used to hold objects that have to be heated in an open flame, slip asbestos tubing over the handles and bind the ends with cord to prevent fraying.—R. R.

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# YOUNG MAN DECLARES HE IS OLD CRANK ABOUT TOBACCO

*Miami Pipe Smoker, Owner of Two Dozen Pipes, Writes About the Mellow Smoothness of His Favorite Brand*

The contentment and pleasure of pipe smoking seem to band all pipe smokers into one great brotherhood. When a man finds his ideal pipe tobacco he wants all his brothers of the fraternity to know it. Here is another letter from a happy pipe smoker who has discovered the one brand that he loves best of all.

Dallas Park Hotel  
Miami, Florida  
November 24, 1933

Larus & Bro. Co.,  
Richmond, Va.

Gentlemen:

I just had to write to you, gentlemen, and let you know how much I think of "Edgeworth."

Although I am only a young man, I am an old crank when it comes to choosing good smoking tobacco.

I possess no less than two dozen pipes of as many descriptions, including corn, clay, Turkish and Chinese, so I know that pipes can sometimes flatter poor tobaccos; but Edgeworth, I can smoke in any grade of bruyere and enjoy. The same mellow smoothness is in every tin, and the aroma that my wife loves so well is like incense around our home.

Many times I have changed to other brands, some of which I thought I had begun to like—then I switched back to Edgeworth (this is what happened tonight, and what prompted me to write this note). It was like meeting a buddy from overseas or a girl from home . . . or something . . . I guess you know what I mean . . .

Respectfully yours,  
Pierre LeRoux

Thank you, Mr. LeRoux. You state the case admirably. Smokers who know good tobacco usually like Edgeworth and are enthusiastic boosters for it.

Edgeworth is made from certain choice and carefully selected leaves of the Burley tobacco plant. You are not deprived of the original flavor of fine tobacco when you smoke Edgeworth. Mildness and flavor form the Edgeworth combination.

Ask your tobacco dealer for Edgeworth. All sizes from the 15 cent pocket tin to half pounds and pounds. Several sizes packed in vacuum tins. In these the tobacco remains in perfect condition in any climate.

Edgeworth is made and guaranteed by Larus & Bro. Co., Tobaceonists since 1877, Richmond, Va.



Particular smokers prefer Edgeworth

## BUILDING SIGNAL TOWER FOR MODEL RAILWAY

A CORRECTLY proportioned signal tower for a model railway can be made by following the accompanying drawings. This is a concrete and stucco interlocking tower. It is not only a realistic accessory, but will also be useful for housing a gang of knife or toggle switches.

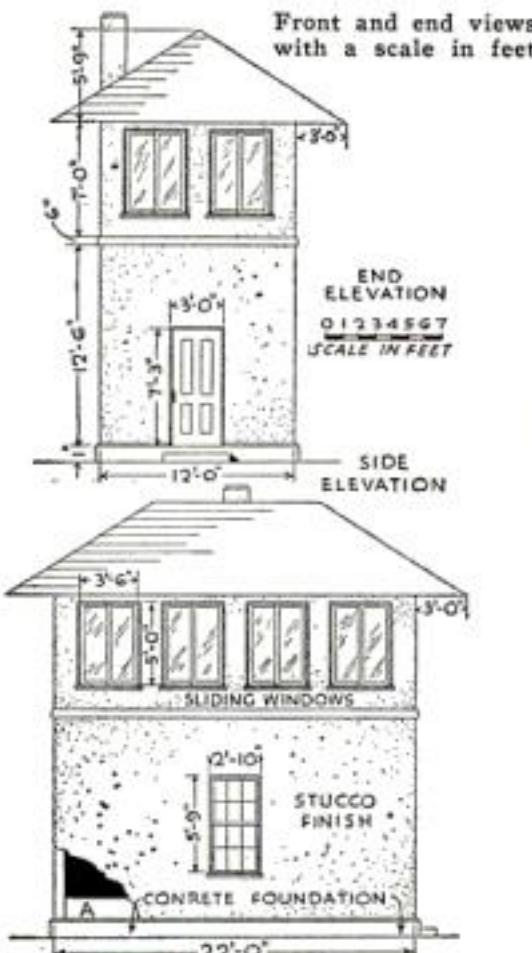
The foundation is cut from a piece of white pine, the upper edges of which are beveled. A second piece of pine is placed on the foundation block as shown at A, and the sides of the tower are glued to this block.

Cut the sides and ends of the tower from wall board or plywood. Before these pieces are assembled, cut the door and window openings. The sashes are cut from cardboard and glued to the inner side of the walls. If the vertical edges of the sashes are lapped along the inner edges, it will give the effect of sliding windows. A small strip of cardboard or wood is glued to the outside of the window, along the bottom edge, for a window sill.

If the structure is used for housing switches, the lower half of the side opposite the single window should be replaced with a hard rubber switch panel. This panel should be hinged, or at least removable, so that all connections can be made on the back.

After the side walls are assembled and before the roof is placed, the sides are covered with medium coarse sandpaper to give the effect of stucco. The foundation block is left unfinished except for the gray paint which is used on the entire tower. Window sills and sashes are painted dark red. The roof is tile red. Doors should be painted a dark gray with light gray panels.

Full-size dimensions and a scale in feet have been provided so that the tower may be built in any size.—J. W. CLEMENT.



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## THRILLING EXPERIMENTS WITH A SPECTROSCOPE

*(Continued from page 48)*

the strip of asbestos paper into the salt solution and bring the wet end into the base of the Bunsen flame. Look through the telescope and you will see a sudden flare along a line across the yellow part of the spectrum.

FOR a reason which we cannot give in this short article, this bright D or sodium line corresponds exactly with the dark D line in the sun's spectrum. Its presence in the solar rainbow proves unmistakably that the element sodium is present in the sun.

In the same way, the presence of corresponding dark and bright lines in the spectra of sunlight and various other earthly elements prove that the sun contains exactly the same metals and gases which occur on earth.

You can make several other analyses of this sort with your crude water spectroscope. For instance, if a strip of asbestos paper is dipped into a solution of lithium chloride, and then held in the flame, a brilliant crimson line flashes out in the spectrum seen through the telescope. If you have no lithium chloride, touch the tip of your cigar to the flame and the red flash proves the presence of lithium in the tobacco.

Another chemical, called thallium sulphate, gives a brilliant green line. If you have no thallium sulphate, you can see a slightly different green line by dipping the asbestos strip into the bottle of boracic acid which is found in most bathroom medicine chests. This green line indicates the presence of barium. In the same way, the solution of a potassium chlorate tablet will give a purple line in the spectrum.

The water spectroscope is intended to help you perform these fascinating experiments in spectrum analysis without the need of purchasing a triangular prism. If, however, you have a sixty-degree prism, or can obtain one, you can do the experiments with it and a slit in a piece of cardboard.

If you have a friend who is interested, get him to place the strips of asbestos paper, wet with different chemical salts, in the Bunsen flame while you look through the prism. Hold it with an edge toward the flame, and a flat side toward your eye. The edge of the prism is of course placed parallel with the vertical flame. You can soon name at sight the different metals present in the flame, either singly, or when two or three strips are heated at the same time.

Through modifications of this simple method which you can demonstrate with the crudest of apparatus, many of the wonderful facts of the physics and chemistry of the stars have been determined. A few have been mentioned. Let us look into one of these a little more closely.

IT HAS been determined that certain stars and nebulae are approaching the earth at terrific speeds. Others are receding from our solar system with equal rapidity.

How did we find this out with the aid of the spectroscope?

In the spectrum of a rapidly receding star, there is a shift of all the dark lines toward the red end of the color band. In the case of a star approaching our earth, the shift is toward the blue end of the color band.

This called the Doppler effect. It can be easily explained by comparison with the whistle of a locomotive or automobile horn as it approaches and then recedes. As the engine comes nearer, the pitch of the whistle rises as the sound vibrations are crowded closer together. When the whistling engine recedes, the pitch of the sound lowers, as the vibrations are stretched out farther apart by the moving engine. When you realize that the red vibrations in the spectrum are of lower pitch than

*(Continued on page 104)*

## THRILLING EXPERIMENTS WITH A SPECTROSCOPE

*(Continued from page 103)*

the blue, the comparison is complete. As the star approaches you the whole spectrum rises in pitch; as the source of light goes away, the entire spectrum is lowered in pitch.

**A**N INTERESTING example of the Doppler effect is given in the illustration. The upper two bands labeled N and S are the spectra of light taken from the upper and lower edges, or limbs, of the sun. They are identical, because there is no rotation of the sun in the plane of its poles. In other words, the north and south poles of the sun remain at a constant distance from us.

But the sun rotates in the plane of its equator in the same direction the earth does. Accordingly the east limb of the sun's globe is approaching us, while its west limb is receding from us.

This fact is distinctly shown in the two spectra labeled W and E. In spectrum W the dark lines are shifted toward the red end; and in spectrum E the shift is toward the blue end. These shifts are shown in the two spectra by the fact that the Fraunhofer lines crossing them fail to match up exactly, as the same lines do in spectra N and S. Being shifted in opposite directions, the lines are staggered slightly.

Since the spectra of some stars differ in many ways from the spectrum of our sun, a photograph of them enables astronomers to classify the different stars by the type of spectrum that each yields.

There are a couple of other interesting sun experiments which you can perform with the aid of a small telescope. One is the demonstration of sun spots. You can of course see more than a bit of smoked or dark-colored glass, but with a telescope you can obtain a magnified image of them.

**D**O NOT, however, make the mistake of looking at the sun through your telescope! Even with a piece of smoked glass this is a very dangerous thing to do. The sun's rays, brought to a focus by the eyepiece or the smoked glass, may crack it and cause blindness.

It is far better to view the sun's image, and any spots which may be present, by projecting the sun's image upon a white card, attached to a little table fastened to the telescope tube. The framework carrying the table can be slipped up and down until the sun's disk is focused sharply. Then any spots present will be seen clearly and can be examined without danger. A cardboard shield with a hole should be used to shade the table from all direct sunlight except that which passes through the telescope.

## ANIMALS, DEAD FOR AGES, POISON THE BLACK SEA

STREWING the bottom of the Black Sea, the carcasses of great beasts that died a hundred thousand years ago are still poisoning its water, according to Prof. Reginald A. Daly, of Harvard University. During the last Ice Age, Prof. Daly believes, the Black Sea was filled with fresh water. Then when the level of the salt Mediterranean rose, it swept over the land barrier and turned the Black Sea to salt water and killed all the fresh water animals it contained. Their bodies, which still lie thick on parts of the bottom, he says, are giving off poisons as a product of their decay and this accounts for the puzzling layer of "poison water" found stretching over 200,000 square miles of the bottom of the sea. The layer rises from sea-bottom, Prof. Daly reports, to within approximately 450 feet of the surface.

## THRILLING EXPERIMENTS WITH A SPECTROSCOPE

*(Continued from page 48)*

the strip of asbestos paper into the salt solution and bring the wet end into the base of the Bunsen flame. Look through the telescope and you will see a sudden flare along a line across the yellow part of the spectrum.

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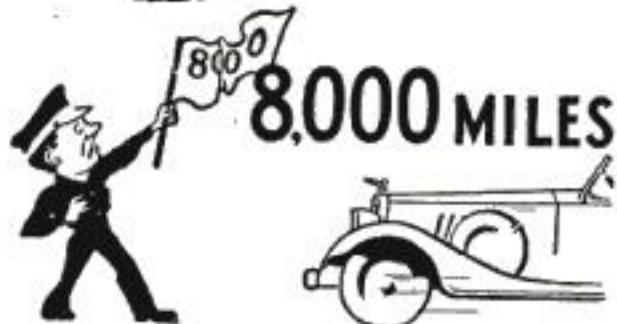
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*(Continued on page 104)*



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## THRILLING EXPERIMENTS WITH A SPECTROSCOPE

(Continued from page 103)

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AN INTERESTING example of the Doppler effect is given in the illustration. The upper two bands labeled N and S are the spectra of light taken from the upper and lower edges, or limbs, of the sun. They are identical, because there is no rotation of the sun in the plane of its poles. In other words, the north and south poles of the sun remain at a constant distance from us.

But the sun rotates in the plane of its equator in the same direction the earth does. Accordingly the east limb of the sun's globe is approaching us, while its west limb is receding from us.

This fact is distinctly shown in the two spectra labeled W and E. In spectrum W the dark lines are shifted toward the red end; and in spectrum E the shift is toward the blue end. These shifts are shown in the two spectra by the fact that the Fraunhofer lines crossing them fail to match up exactly, as the same lines do in spectra N and S. Being shifted in opposite directions, the lines are staggered slightly.

Since the spectra of some stars differ in many ways from the spectrum of our sun, a photograph of them enables astronomers to classify the different stars by the type of spectrum that each yields.

There are a couple of other interesting sun experiments which you can perform with the aid of a small telescope. One is the demonstration of sun spots. You can of course see these great whirlpools of flame with nothing more than a bit of smoked or dark-colored glass, but with a telescope you can obtain a magnified image of them.

DO NOT, however, make the mistake of looking at the sun through your telescope! Even with a piece of smoked glass this is a very dangerous thing to do. The sun's rays, brought to a focus by the eyepiece or the smoked glass, may crack it and cause blindness.

It is far better to view the sun's image, and any spots which may be present, by projecting the sun's image upon a white card, attached to a little table fastened to the telescope tube. The framework carrying the table can be slipped up and down until the sun's disk is focused sharply. Then any spots present will be seen clearly and can be examined without danger. A cardboard shield with a hole should be used to shade the table from all direct sunlight except that which passes through the telescope.

## ANIMALS, DEAD FOR AGES, POISON THE BLACK SEA

STREWING the bottom of the Black Sea, the carcasses of great beasts that died a hundred thousand years ago are still poisoning its water, according to Prof. Reginald A. Daly, of Harvard University. During the last Ice Age, Prof. Daly believes, the Black Sea was filled with fresh water. Then when the level of the salt Mediterranean rose, it swept over the land barrier and turned the Black Sea to salt water and killed all the fresh water animals it contained. Their bodies, which still lie thick on parts of the bottom, he says, are giving off poisons as a product of their decay and this accounts for the puzzling layer of "poison water" found stretching over 200,000 square miles of the bottom of the sea. The layer rises from sea-bottom, Prof. Daly reports, to within approximately 450 feet of the surface.

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### BEAUTIES OF SPRING SEEN IN MICROSCOPE

(Continued from page 41)

tincture of iodine at one edge of the cover glass and apply a blotter to the opposite edge. The blotter absorbs the water, and the iodine flows beneath the glass to take its place. Watch the round grains. As the iodine reaches them, they turn blue.

Now you know the answer. The eggs in the tiny baskets are starch grains in their cells. When you pulled the covering from the cotyledon, some of the starch grains stuck to it. Scrape the surface of the cotyledon with a knife and you can get all the starch grains you want. The bulk of the bean is composed of starch, stored in the cotyledons where it can be used as food by the tiny plant while it is developing leaves and roots that will enable it to take its nourishment from the earth and air after it has been planted.

**A BEAN** is a seed. You can confine your microscopic wanderings for a time to inspecting seeds. You will discover that nature showed amazing ingenuity when she contrived to have seeds scattered far and wide. She equipped some with feathery wings, so that they can ride the winds. Others, she fitted with barbs, so that they can cling to clothing and animal fur, and be carried to distant places. The seeds of certain plants are made with air chambers so that they can become sailors and travel over water. Still others have tough coats that prevent them from being digested when eaten by animals. The surface markings of the poppy, cucumber, and scores of other seeds are interesting. You will learn, with some amazement, that some of the things you have been calling seeds are not seeds but fruits, in the true sense of the word. For instance, the hard, dark specks in strawberries are, to the botanist, not true seeds but akenes or seedlike fruits.

In any garden or field you can shut your eyes and grab a handful of microscopic wonders. Here, for instance, is a leaf from the Wandering Jew vine. Turn the leaf upside down and lay it on a slide. Shoot a strong beam of light through it, and focus on the surface, at fifty to 100 diameters. You find that, over the leaf surface, are distributed slitlike openings in specialized cells. These are the breathing pores of the leaf, the passages through which carbon dioxide enters the air sacs within the leaf.

All leaves have breathing pores, but the forms and sizes vary. The Wandering Jew leaf is one of the easiest to examine.

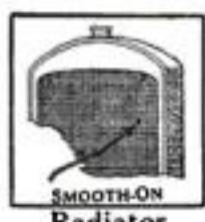
With a piece of cork or cardboard as a butchering block, and a straight-back or safety-razor blade as a knife, slice thin sections from a leaf, cutting across one or more of the veins. Probably you will find this a little harder than it sounds; but the law of averages will assure you of several very thin slices. Mount these on a slide, in water.

**T**HE veins, composed of specialized cells for carrying water and providing strength to the leaf, are most prominent. On either side of them extends the main body of the leaf. The surfaces are covered with a layer of colorless cells, forming the epidermis. In the lower epidermis are the breathing pores. Directly above it are open spaces or air sacs. Then, massed together into a solid wall, are the cells containing chlorophyll. At high magnifications, say 300 diameters, you can see more plainly the little disks of chlorophyll arranged inside the cells.

This chlorophyll, by the way, is the most important material in the plant world. It is the center of a great mystery. In some manner, the chlorophyll takes sunlight and water and carbon dioxide and manufactures from them oxygen and (Continued on page 106)

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### BEAUTIES OF SPRING SEEN IN MICROSCOPE

(Continued from page 105)

sugar. Thus, a plant growing in a lighted, closed room is a purifier, absorbing carbon dioxide and giving in return pure oxygen. That probably is one reason why there is a noticeable difference between country air and that of a crowded city.

The upper epidermis of some leaves, such as the tomato and begonia, produce hairs or trichomes, that always are interesting as microscope subjects. Simple hairs show a remarkable structure of cells, arranged one upon the other like building blocks. Some leaves bear complicated structures, resembling small anvils, branched spikes, and other queer shapes.

Stems always are fascinating because of the ingenious arrangement of the various cells that make up their structures. It is a good plan to collect stems from plants that are not closely related, such as a water lily, a young pine tree, and a climbing vine. Slice them into thin sections and mount temporarily in water.

By using various stains, you can bring out certain details of stem and leaf sections. In fact, some of the most beautiful objects you can prepare for your microscope are such sections treated with one or two stains, such as methylene blue and eosin.

THE plant world is so vast that you need have no fear of exhausting its possibilities, for many springs to come. As a suggestion, you might examine individual moss plants, particularly the fool-cap arrangement at the tips of the stems, in which spores are produced. Get a dandelion blossom and split it apart. Examine one of the rays. It is a tiny flower in itself, so that the blossom is really a collection of smaller flowers.

On the underside of fern leaves you will find brown spots. These are the spore-producing organs. Pollen from flowers is a favorite microscope subject. You will find that the grains appear in endless variety. To collect pollen, tap the flower against a glass slide. You can watch pollen grains germinate by placing them in sweetened water, in a deep cell.

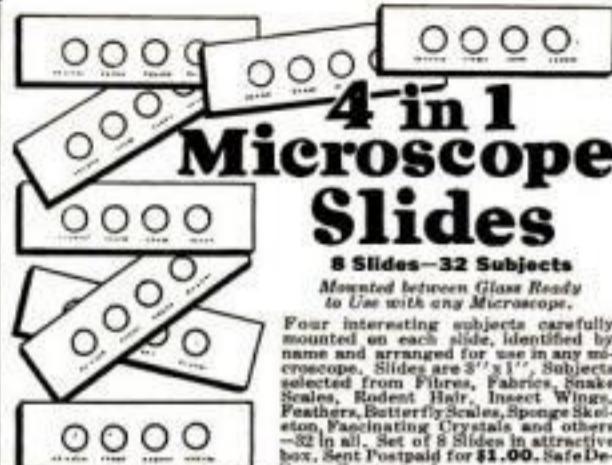
You remember that crystals were present in the bean shell. You can find a wider variety in most leaves. Here, for example, is a bright green, watery leaf from the Begonia. With a razor cut it into thin slices, mount them in water, and examine carefully the cells in the vicinity of the veins. You will find numerous crystals, some large enough to fill the cell completely, others so small that they are difficult to see. Here in a six-sided cell is a beautiful crystal mass that looks like a many-pointed star. It is a group of calcium oxalate crystals. In other cells, you can find simpler crystals of calcium carbonate.

No one has been able to discover that these beautiful crystals are of any service to the plant. It is believed that they are waste products, resulting from the routine activities connected with growth, and that the plant simply imprisons them in certain cells and ignores them.

ONE of the biggest pleasures in using a microscope is exhibiting wonders to friends. But how disappointing it is to explain patiently just what the friend should look for, and then have him inquire: "Which spot is it?"

You can avoid such situations in a very simple way. Merely equip the eyepiece of your microscope with a pointer. Then, by moving the object so that the detail in question is at the end of the pointer, you will have no trouble in directing your friends' attention just where you want it.

The pointer consists of a fine, pointed hair cemented in the eyepiece. A hair clipped from a camel's hair (Continued on page 107)



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## BEAUTIES OF SPRING SEEN IN MICROSCOPE

(Continued from page 106)

brush is excellent, and Canada balsam is a good cement. Unscrew the upper lens of the eyepiece and determine whether the tube is equipped with a diaphragm somewhere between the upper and lower lenses. If it is, cement the hair to the top surface of the diaphragm, arranging it so that the tip comes in the center of the opening. Standard Huygenian oculars, such as those used on the more costly microscopes are treated in this way. Some popular makes of amateur microscopes have eyepieces of different type. In one make, for instance, you will find that the two small lenses are arranged at the ends of a slender tube having no diaphragm. The place to affix a pointer hair on this type is the lower end of the tube.

WHEN the ocular is in place and the microscope focused on an object, you should see the hair silhouetted sharply against the field. If it is not sharply defined, change its position until it is. If you find it bothersome to have the hair projecting halfway across the field of vision, use a shorter hair, so that the tip is visible a short distance inside the field.

The microscopist accustomed to using a high-grade instrument is lost when he tries to get along without a substage diaphragm, a variable light-stop, resembling the iris diaphragm of a camera shutter, placed between the stage and the mirror. However, makers of amateur microscopes frequently omit this most useful of accessories. By equipping your microscope with an adjustable stop arrangement, you can improve its performance. The idea of the diaphragm or stop is to exclude all light that does not contribute to the sharpness of the image.

There are so many kinds of microscope stands and shapes of stages that general directions for attaching a stop holder cannot be given. The method illustrated will, however, be found suitable in a great many cases. Simply cut a piece of sheet brass so that it projects beyond the stage about one-quarter inch on each side. Bend the projecting portions at right angles so that they will grip the edges of the stage. Place a drop of solder at each corner of the piece, on the inside of the bend, and with a file remove excess solder until the brass piece lacks about one-sixteenth inch of touching the bottom surface of the stage. Its edges should not, under any circumstance, project above the surface. Rack the microscope tube upward as far as it will go and, with a pencil or nail, mark a circle on the brass to correspond with the circular opening of the stage. Remove the brass piece and cut out the circle. That completes the light-stop holder.

THE stops themselves consist of rectangular pieces of sheet brass, copper, zinc, or aluminum. Cut them to slide snugly but easily into the compartment between the holder and the stage, and make them long enough to project about one-quarter inch in front, so they can be grasped. Mark circles on the stop blanks as you did the holder, but do not cut the circles the same size. Instead, drill various sized holes in their exact centers, say in sizes ranging from one-thirty-second inch to one-fourth inch, in one-thirty-second inch steps. A little experimenting will reveal the most useful sizes for your microscope. It is important that the stop be centered in relation to the objective lens. Usually, two holes can be drilled in each metal blank.

In addition to light-stops, the substage attachment can be used for holding light filters made from colored glass, or from colored cellophane or gelatin fastened to cardboard pieces having center openings the size of that in the stage.



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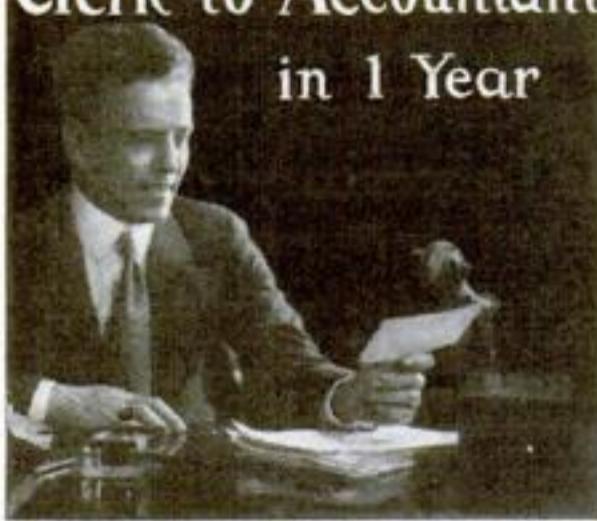


# Secrets of Success

STORIES THAT WILL HELP YOU GET AHEAD



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From clerk to bookkeeper is ONLY A STEP. When you back experience as a bookkeeper with practical training in an accountant's duties, you ENTITLE YOURSELF TO A TRIAL at the bigger job. If your training is right, you have no difficulty in making good—and THE JOB IS YOURS. Best of all, with the change in work comes the increase in pay.

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LET US GET YOU READY for that better job and increase in pay that you want. As soon as you have completed your preparation, we shall be glad to lay your qualifications before employers in your locality—to recommend you as a CAPABLE AND DESIRABLE addition to their working force.

### Line Up for a Good Job

Today, many men are holding jobs for which they're not fully qualified. In the continuous weeding out process, they're IN DANGER of being replaced by better-trained workers. They could SAVE THEIR JOBS and put themselves in line for promotion by getting a little better training.

It's not an accident that WELL-TRAINED MEN GET THE GOOD POSITIONS. Avoid accidents—"play safe" by preparing yourself for a worth-while job. If your present income isn't satisfactory—if there's nothing better in sight—if you're not even sure of being kept on in your present job—take the FIRST STEP TOWARD PROMOTION by asking us how you can prepare yourself during your spare time. Coupon will bring you full information without obligation.

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EDITOR'S NOTE: Men can be ingenious about making a living. Money problems bring out the best in them. Determination to succeed is often the influencing factor in their lives. That is what we have learned from the hundreds of stories submitted to this department since it was started, almost two years ago.

One man cultivates tropical plants on a lonely, abandoned island—and sells them to the rope-making industry. Another gets his feet wet working on docks. To end the discomfort he invents a special waterproofing substance—and a new business is started.

Don't you know some one who has made good because he had to make good? Perhaps it's you—or a close friend of yours? Send in the story. It will help others, and you, too—for \$5.00 is paid for each one published. (See rules at bottom of page 110).

### PICKING FERNS SOLVED HIS MONEY PROBLEMS

WHEN Frank Fisher was sufficiently recuperated from a siege in the hospital he found that the world had gone financially "hay-wire". His little auto-repair shop, just outside Chehalis, Washington, had never been over-lucrative even in good times, and now it seemed that the country's automobiles had taken to their holes.

And how the bills had accumulated during his confinement! To meet them he was forced to sell his shop equipment. With a small "stake" he moved to Seattle.

At every garage where he applied for a job the answer was always the same. "We've had to let some of our men go." It became painfully apparent that in his case specialization was a handicap. Frantically, he looked to other fields of endeavor. In the course of his search, he recalled a conversation he had had with a friend while bed-ridden. This friend had mentioned fern picking as a means of earning a living.

After interviewing a number of Seattle florists, Frank Fisher found that there was a constant demand for a certain species of evergreen which grows as abundantly as weeds in certain sections of the Pacific Northwest. The prices paid for ferns—they have no value in themselves and are used only to enhance the attractiveness of

(Continued on page 109)



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## Secrets of Success

### PICKING FERNS SOLVED HIS MONEY PROBLEMS

(Continued from page 108)

flowers—and the labor involved in procuring them, accounted for the under-supply. But, one fact impressed Frank. There was a market for every fern that he could pick!

He had all the equipment necessary to begin his self-appointed job: an old Ford, a few dollars for grubstake, and plenty of determination.

The actual gathering of the ferns was the least of his troubles. After a short time he became hardened to the back-bending task of breaking off ferns by the roots for from eight to twelve hours a day. The chief difficulty lay in finding locations where the plants were sufficiently prolific to insure a profitable harvest. In respect to locality, ferns are as inconsistent as gold.

Today, Frank Fisher is a "company." He has had helpers, but none stuck with him long enough to become of real value. "Too hard work and too long hours," they said. So Frank works alone. Used to hard work and never afraid of long hours, he supplies most of Seattle's flower shops and many in the East.

Recently asked if he would accept a mechanic's job, Frank Fisher replied: "Not as long as ferns grow wild. Why should I?"—E. A. T., Seattle, Washington.

### NEED FOR RURAL SERVICE CREATED THIS BUSINESS



JOHN SMITH lost his job late in 1931 along with many other men, when the firm for which they worked closed in bankruptcy. For 17 years he had worked in the one place, had married, furnished a nice home and had brought up two pleasant youngsters.

He hunted in vain for work in his own line, then in other lines, and finally tried unprofitable house-to-house selling propositions. His assets dwindled to less than \$100 and an old light sedan, in good mechanical condition.

During a visit to a relative in the country he saw that the rural dwellers were not being served by delivery men and peddlers as are city folk. His relatives went to town once a week, when they bought the grocery supplies, and had no opportunity for further purchases until the next visit to town. Smith decided there was a service to be performed for rural people and decided to perform it himself. He would bring fresh fruit to their homes.

Two crates of oranges, one of lemons, and two bunches of bananas were his first stock in (Continued on page 110)



## HE'S FINISHED HIGH SCHOOL WHAT WILL YOUR SON DO NOW?

THERE was a time when a boy could step from high school graduation into a job. The boy who does it today is fortunate indeed. The inability to do it is not always a reflection on his ambition or his ability. In many cases the job is not there.

The economic horizon is brightening—there's no doubt about that—but there are millions of trained men, with families dependent upon them, waiting to fill jobs as they materialize. All the organized forces of society and government are working to solve the unemployment problem.

At the moment it's a serious outlook—and a sad one for the boy. He is willing to work but cannot find work to do. He is at the peak of his energy and his enthusiasm. Shall he begin life in bitterness, or in brooding over his fate, or make associates and acquire habits that would have never tempted him in normal times?

Your greatest responsibility to that boy is TODAY! He needs your advice and your guidance more than he ever needed it before.

Why not, then, encourage him to devote a systematic portion of his spare time to the study of something which will engage

his thoughts and—more important—give him training which will be of inestimable benefit to him in the years ahead? This study can give him a new vision of life, inspire him to greater achievements. Apprenticeship is still necessary, but employers prefer young men whose attitude and preliminary training qualify them to adapt themselves to the employer's needs.

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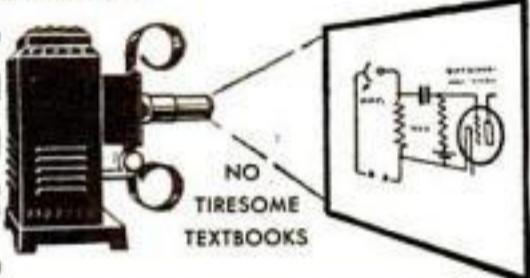
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## Secrets of Success

### NEED FOR RURAL SERVICE CREATED THIS BUSINESS

(Continued from page 109)

trade. He loaded them in the rear of his sedan and started out to canvass homes on a country road which led from his city.

His sales average \$20 a day, of which about \$8 is profit. Out of that he must operate his car and take care of any losses from left-over fruit.

From the first week he has earned a living wage, although it required some time to work up his trade to the point where he could sell \$20 worth of fruit each day. He laid out six daily routes from his home town, the longest of which is 31 miles. He makes his first call about 8:30 o'clock in the morning, after most housewives have sent their children off to school. He usually is home by 4:30 o'clock in the afternoon.

Six months after Smith started his business he was able to buy a small, used truck which is more convenient. It has a closed body, within which he has a heater to protect his fruit in winter.

People living in rural areas are pleased at the opportunity to buy fruit at their own doors, and practically every one of his customers buys regularly on each weekly call. Because the average sale is small (less than 60 cents) Smith runs a cash business. He charges good prices, but delivers choice fruit. A few of his farmer customers trade live chickens to Smith, who pays the wholesale price. Other customers of his always buy these chickens at a fair retail price, which adds a bit to his income.—E. L. Poughkeepsie, N. Y.

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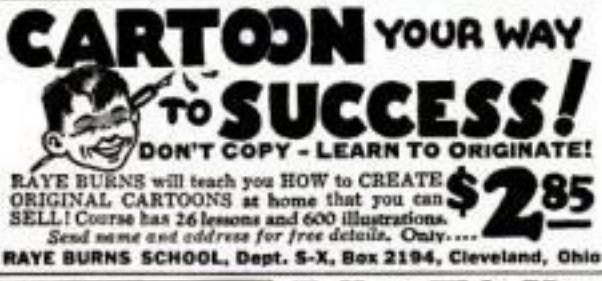
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## TUNING UP CAR FOR SUMMER USE

(Continued from page 66)

The best way is to flush the radiator and motor separately; that doesn't force the muck from one into the other. Simply leave the filler cap on the radiator and push the end of your garden hose up into the bottom connection. That will send the water backwards through the core and loosen all the scale.

"To flush the motor, push the hose end into the bottom connection pipe and let the water work its way up through the block and out the top connection. You can tie a length of inner tube to the regular hose pipe to lead the dirty water away from the motor. The main idea in flushing it to force the water backwards through the system.

"**FINALLY**," Gus concluded, "you can play your hose on the radiator core from the inside to clean out all the bugs and dirt that clog the honeycombs."

"Gosh, flushing is a regular week-end job in itself," groaned Stanton. "And I suppose there are about a million other things I should do, too?"

"Well," said Gus, "that depends on the condition of the car. But no matter how you figure, the first item on your list should be the radiator flushing and a general overhauling of the cooling system—and that includes fan belt, hose connections, and water pump. Next comes a general check-up of the brakes and front wheels. Shimmy and braking troubles may not be so noticeable in the winter when you're driving slow on slippery streets, but they're bound to show up in the spring.

"Weak coils are another thing that act up in the spring of the year when you start pushing your car for speed and pick-up. You'd better put that down as number three. A weak coil will make the engine miss fire and that means overheating.

"Then there's your valves and spark plugs. They always deserve a little attention after a hard winter of overchoking and cold weather starts. You ought to check up on the ignition timing too," added Gus, "it's liable to be a trifle late.

"In other words, check everything that's apt to cause overheating and that includes the oil you're using."

"Say, Gus," put in Stanton as he examined one of the hose connections, "isn't there something you can do to prevent all this muck from forming in a car's cooling system?"

"Sure. After you get through flushing, you can add some rust preventive to the new water. There are several good brands on the market and they aren't expensive either. At first they form an emulsion with the water but after the car has been driven a few miles they separate out to form a thin film of oil on all the inside surfaces.

"Another good way to keep the cooling system clean is to be careful what kind of water you use. Always try to avoid well water when you're out on trips. It contains all sorts of minerals and salts that form a regular armor plate in the radiator and block."

"Anything else you'd suggest for a thorough job?" asked Stanton.

"**WELL**, you might give the car a good washing and polishing," returned Gus. "Pretty soon now you'll be hiking along hot roads under a broiling sun, so you want to replace that skin of dirt with a film of polish.

"And by the way," Gus added as he passed the opened rumble seat on his way through the driveway, "a little time spent cleaning the leather on that rumble seat wouldn't be wasted. Wipe it off with a rag moistened with water, mixed with a few drops of ammonia. Then rub it down well with some leather dressing or a homemade concoction of linseed oil and half as much turpentine. There's a lot more kick in driving a clean car."



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## STRANGE CREATURES MAN HAS TAMED AS HIS PETS

(Continued from page 33)

"It was a horned palm viper," he explained. "A very deadly snake, but generally good natured in captivity and seldom offers to bite when disturbed."

A harmless snake, colored like the viper, created a furore at the annual National Pet Show in Madison Square Garden, New York, last winter, when it escaped and then turned up at odd places and times, and wriggled over the ankles of women spectators. At a smaller pet show in New York's lower East Side, a big blacksnake entered by a schoolboy won a prize as the oddest pet. It would have seemed less odd farther South, where blacksnakes are sometimes kept in homes and stores to kill mice.

TURTLES are popular now, and every day the Zoo is asked how to care for them. One pet shop recently sold 5,000. They were geographical turtles whose back resembles a map, a dwarf turtle only an inch and a half in diameter. Ten-cent stores sell them with shells painted bright colors with vegetable paint. Chemical paint would clog their pores and kill them. The thousands of people buying them, should know that these turtles are amphibious and need both land and water in order to be healthy.

When you have a turtle pet, if you care for him, you have him. Turtles are said to live to a great age. For ten years, a turtle was mascot of a public school, carried a pencil in his jaws, and otherwise showed education. Most intelligent of all reptiles, is the giant land tortoise now becoming extinct. To save it, Dr. Charles Haskins Townsend of the New York Aquarium imported 180, that are now growing finely to their maximum of 500 pounds. He kept one on Long Island that let children ride on its back, and steer it right or left, by holding over its nose, an apple or a banana on the end of a stick.

They are sluggish, as is also the Gila Monster, the only poisonous lizard in America. The Gila is no beauty, but he is too lazy to resent captivity. His jaws have a bulldog grip and his fangs inject poison. Some harmless lizards are in demand as pets, especially the old familiar chameleon of changing colors. An enterprising pet dealer once imported some so-called singing lizards. Their constant whistling, not singing, drove everyone wild, including the pet dealer who was glad to get rid of the annoying little creatures.

The most popular reptile pet is the baby alligator; so popular, that in some places, the kill is limited. In Florida, Georgia, and other Southern States, many swamp men make hunting 'gators and frogs their life work. They get from five cents each for baby 'gators, to five dollars each for seven-foot specimens. Alligators sometimes reach sixteen feet. The eggs are hatched in holes in the bank, whence the babies scuttle for water. The hunters grunt like a mother 'gator, then when the trustful little ones come to the surface, scoop them up in bags. But the grunting may be so lifelike as to bring a grown 'gator. Then there is a struggle.

IN FIGHTING a 'gator, look out for his tail. With it he will slap you down, then swish you within range of his frightful jaws. Once he grips anything, the 'gator starts backing toward his cave, dragging his prey. But those jaws have a weakness, which 'gator hunters know. The muscles that open them, are weak. Tempt the 'gator to snap his jaws vainly, then, like a flash, before he can reopen them, grab his snout. Then shoot or harpoon him, not once, but plenty of times. He has tremendous vitality. Some-

times, when harpooned, he will rush off, towing a boat for a long distance. Hunters detect an alligator's cave by the musky odor, lean over the hole, thrust in a pole with a hook on the end, drag out the reptile and kill it. Generally the alligator will seek to escape and unlike the crocodile will seldom attack a man and none of them is man-eating as is the Nile crocodile, of evil reputation.

Alligators seem to recognize no individuals, although a Frenchman, Baron de Longeville, had one that he claimed would croak when he called its name. Still, they are popular, and the New York Aquarium keeps up its supply by airplane.

BELIEVE it or not, a resident of New York used to keep scorpions and tarantulas as pets. He got them from Latin-American fruit boats, and kept and exhibited them in a steam-heated cellar, in a terrarium with a big glass top. He fed them water bugs, and organized regular tarantula fights.

There have been pet snails, too. One got a prize at a pet show at Westfield, N. J. Another belonged to an American woman at Cannes, at which well-known resort she fed the snail lettuce in prominent restaurants.

From reptile pets to insect pets is no long jump, considering popular dislike for both. A student took a praying mantis to Cornell, and kept it in a shoe-box. He would take it out for a walk on his finger, or to eat flies, or to drink water from a teaspoon. It would climb over his clothes like a chameleon. Many people keep crickets in boxes for their cheerful singing, which is not singing, but scraping of their hind-legs, and in some primitive regions, natives use large fireflies for illumination. The most famous flea-circus trainer in New York, feeds his pupils on his own arm.

But keep blood away from your pet leopard, ocelot, cheetah, puma, or other carnivore. When it begins to growl as it eats meat, and grow claws, you better give it to the Zoo. Of course, some carnivores stay tame. A coffee manufacturer named George Washington, leading Eastern pet fancier, had a sort of private zoo prowling about his estate, first on Long Island, then at Mendham, N. J. He had a cheetah, that ate breakfast with him. Cheetahs are often tamed in India, where rajahs use them on hunting expeditions.

A young girl recently exhibited at the American Museum an ocelot trained so well, that it amazed the animal experts there. Mrs. Bertha Embree brought from Texas to Flushing, N. Y., a big gray timber wolf that followed her around like a police dog, and never bit anyone.

BARON ROTHSCHILD, wild animal enthusiast, had two trained zebras that he drove through London. In London, Mrs. Herbert Vivian had a pet gazelle that delighted in pulling parlor-maids' cap streamers, biting guests' shoestrings or licking off blacking, snatching food from plates, and afterward proudly strutting around the room.

A miraculous pet skunk, called "Sachet," was playful, too. When its master was at work, it would climb up onto the desk, and play about among the nicknacks. This is vouched for by William H. Carr, assistant curator at the American Museum of Natural History, who explains:

"Skunks are not dangerous unless annoyed or attacked. Treated kindly, a young skunk is one of the gentlest, most playful, and most interesting of pets. The scent sac, may, of course, be removed by operation, but the little (Continued on page 113)

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## STRANGE CREATURES MAN TAMES AS PETS

(Continued from page 112)

animal, knowing it has lost its means of defense, loses all its lively spirit."

If a skunk as pet, why not a porcupine? Lowell and Irene Finley had one, Dinty, who, caught young, imbibed sugared milk from a milk bottle, with a gentle, cooing sound. He followed his master and mistress around like a dog, climbed into their laps to have his back rubbed. While that was going on, he kept his quills down, and never moved his barbed tail in the vicious slap that is a porcupine's most dangerous blow.

**A**NOTHER strange pet is the mouse deer. It is a perfect little deer, seven inches high, body about the size of a small rabbit, thin legs and tiny cloven hoofs. It has no antlers, but in its upper jaw are two-inch curved tusks. By these tusks it hangs from a branch when chased by larger animals. Mouse deer are often pets in India and Malaysia, where they figure in folk lore. Mrs. Maxwell Maynard caught one in Mysore that weighed thirteen and one half ounces. She petted it constantly, fed it milk and water, and it grew to four and one half pounds. Every night it went into the jungle, but every morning returned for breakfast.

Perhaps to the average American, the oddest animal pet seems to be the white sow that follows Abe Martin about the streets of Emmett, Mich. It turns right or left as he bids, and when it thinks it has lost him, squeals vociferously.

"Birds are less intelligent and teachable than animals," says Lee S. Crandall, curator of birds at the Bronx Zoo. Furthermore, parrot wisdom is mostly imitativeness.

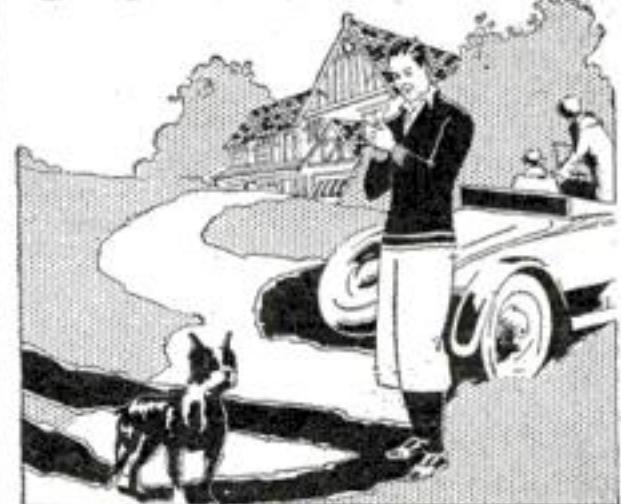
Almost all birds, including exotic tropical species, can tell one person from another. The rarest bird in the Bronx Zoo, a stork-like hornbill, will bite any keeper but an old German named Hofman who calls him "Mein Chimmy" and scratches his bill. He has won the hornbill's favor by tactics all bird lovers employ: he is quiet, yet cheerful, and avoids sudden moves.

Hofman is the only keeper who can safely visit the great vultures with their cruel beaks. These scavengers look less like pets than any bird, yet one lived for some time in the tent of Roy Chapman Andrews, the explorer. He took it from its nest in the Gobi Desert, and fed it himself. Now when he returns to the Zoo, it does not recognize him. The vultures around the old Charleston, S. C. meat market were so tame that customers pushed them out of the way.

**T**HREE landed in this country recently, an Englishman with a pet Scottish golden eagle, a big bird that perches on his wrist, and obeys his voice. He is Charles W. R. Knight, one of the few surviving experts on the ancient pastime of falconry, that is, training eagles, hawks, falcons to hunt rabbits, grouse, and other small game. George Goodwin and E. T. Teft have imported the sport to this country, and hawks are now trained at Brewster, N. Y. and Fisher's Island. Goodwin has trained and flown in America duck hawks, gishawks, Cooper's hawks, and sharp-shinned hawks.

A snowy owl from the Arctic Circle was the pet of T. Donald Carter of the American Museum in the winter of 1926-27 when these birds flew southward as far as North Carolina. Despite rumors, they were apparently harmless, and ate rats. This one was called "Jimmy," but he was a female. In Steuben County, New York, she got her wing broken, and was sent to Carter for repairs. This arctic bird preferred the warm kitchen, soon began eating from her hosts' hands, and let them stroke her.

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## KEEP YOUR TREES HEALTHY WITH THESE SIMPLE RULES LAID DOWN BY EXPERT

(Continued from page 62)

The most effective way to irrigate is to dig a ditch or basin around the tree at the ends of the branches. If it is necessary to have some of your trees against buildings, heavily packed driveways, concrete, or asphalt, dig the trench in the shape of a horseshoe. Do the best possible under the circumstances.

IT IS better, of course, to give all trees ample room where they can receive nourishment and water on all sides. In a space no larger than fifty by 140 feet you can have twenty trees in three rows twenty feet apart. Excepting walnut, which requires more space than any other, you can have selections of your own choosing—plums, peaches, pears, chestnuts, filberts, prunes, apples, almonds, and any that fit your particular section. Apricots, cherries, and apples should be planted along the outside edges and the walnut will grow better in a corner near the house where its protective shade will be appreciated during the hot days of summer.

Most people are interested in deciduous fruit trees because of their wider adaptability and beauty. These, in some cases, will reach you from the nursery without any ball of soil covering the bare roots. When planting, be sure to space them regularly. This will make for both good health and beauty. In planting, dig a hole of such depth that the tree will stand at the same level as in the nursery and large enough to permit the roots to spread without restriction. After filling the hole nearly full with top soil, pour in ten gallons of water. Do not press the soil down. The water will perform this function adequately. Never fertilize the soil that comes in contact with the roots.

Since all deciduous fruits should be cut back after planting, it will be well to follow these rules:

Peaches, apricots, plums, pears, nectarines, apples, quinces, cherries, persimmons, and almonds should be cut back from eighteen to thirty inches, depending on the diameter of the trunk, if they are whips, that is a single trunk with no lateral branches. Strong, well-branched trees should be headed at thirty to thirty-six inches and only three to four equally spaced branches left on. These branches must be cut back to three or four inches from the main trunk.

The pruning the second winter after planting is confined largely to developing the main framework of not more than four well-spaced branches.

A coating of whitewash containing a little carbolic acid is advisable on all young deciduous fruit trees as soon as planted to prevent sun scald and attacks from borers. Yucca or paper tree protectors will serve the same purpose and prevent injury from rodents.

IMENTION pruning quite casually, yet the proper performance of this function is highly important. Be sure to cut the limbs flush with the trunk, leaving no stubs. Seal each open end with wax. This requires only a short time and little effort and may prevent decay. Not infrequently these stubs decay and eat back into the body of the trunk, which explains the rotted knotholes so frequently noted in otherwise healthy specimens.

At times, fruit trees lose the majority of their blossoms, sometimes dropping so many that an inadequate crop of fruit results. Recent experiments have shown that if you go through the tree with manicure scissors, cutting away blossoms formed in clusters and thus thinning the tree in about the same proportion as the usual loss, the process will in-

sure the retention of an adequate number of blossoms for a healthy fruit yield.

On any type of flowering fruit tree, be sure to pick any stray fruit before it matures, else within a few years the tree will cease to blossom.

Do not overlook rotting places or injured trees. Cut out any rot immediately and apply some filler. If this occurs to the vertical trunk, the cavity may be completely filled with cement; but never place a heavy load in a branch for the added weight will create a stress at the union with the trunk which will stunt its growth and eventually kill the limb.

IN CASE only the bark becomes damaged, try to get a piece from a tree of similar size. Taking care not to break the bark, cut this to fit and nail it in place, exactly as you tack down a carpet. Then seal the heads and crack with wax. On several occasions, where cattle had eaten away the bark completely around the tree, I have placed a stocking of bark, in the manner described, around the injured trunk. Properly sealed, this should be effective anywhere on any trees.

Where trees are exposed to an excess of sunshine, they sometimes become barkbound. Here you need only run the blade of a knife down the trunk or limb, but do not cut through a bud. Rather, circle the buds. Since the sun has drawn out an excess of moisture, causing the bark to contract and slowing down the delicate circulation system, this little trick will loosen the outer skin and permit nature to take its course.

I am often asked about fertilizers. In many parts of the country, the soil lacks nitrate. Here a mixture containing equal parts of blood meal, bone meal, and sulphate of ammonia, two and one-half pounds to small trees, will supply the deficiency. In the East this should be applied in the spring before the rainy season, while the autumn is the better season for treatment in the West. Merely place the fertilizer in the trench and water will carry it down.

IF THE tree is losing its blossoms or foliage, a mixture of bone meal and sulphate of ammonia often supplies the necessary nourishment to retain the leaves. This is especially good for fruit trees six weeks before blossoming. In any event, it will do a tree no harm under any circumstances as a growing tree needs nitrate so you need not be afraid to use it as a fertilizer.

Some trees, especially the peach, develop cankers. Here the gum appears on the bark and makes an ugly sore. We have found in experimenting in our grove that this disease can be cured by cutting vertical slices in the bark, three-fourths inch apart and placing in the wounds a one and two-thirds percent solution of copper nitrate in equal parts of denatured alcohol and water.

We once relied upon sprays to cure nearly all diseases of trees, but we now know that most troubles come from or through the roots. To meet these troubles, we usually must supply chemicals containing missing mineral substances. Exantena, a disease which causes the tree to dry up, is a case in point. To remedy this condition, bore small holes into the trunk and pour powdered copper sulphate into them. Then place the same chemical in solution in the basin.

Most of these methods and cures may be applied to any tree in any part of the nation. By following these suggestions, you may have a vigorous growth of trees, whether evergreen, deciduous, or ornamental, in the back yard or on a large farm.

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## UNCLE SAM'S TREASURE HOUSE FOR GOLD

(Continued from page 52)

Dredging for gold has been successful in both Alaska and California. It usually is used for mining wide gravel deposits. All the machinery is mounted on a barge which floats in a pond made by filling with water the excavation it has made. A line of heavy buckets mounted on an endless conveyor dig up the gravel and deliver it to a hopper in which it is washed. Then, under water pressure, the gravel is forced through revolving screens called trommels, and further disintegrated. It then is sent through sluice boxes, in which the gold is caught, and the tailings are stacked behind the dredge by a conveyor belt. In 1932, over three quarters of the placer-gold production of both Alaska and California was mined by this method.

HYDRAULICKING is another form of large-scale placer mining that has been successful. Water shot at high pressure from nozzles called "giants" is used for breaking down and disintegrating the gravel and for washing it to the sluices. Under favorable conditions operating costs are low, and pay dirt of very moderate quality may be handled profitably.

The simplest form of power placer mining is the use of a drag scraper operated by a double-drum hoisting engine. The hoist is located at the head of the sluice box, and by the use of blocks and movable tail sheaves the pay dirt may be excavated and carried to the sluice from over a considerable area without changing the location of the hoist. Scrapers, operating from overhead cables, also are used in this form of mining.

During the last few years the combination of widespread unemployment and the ever-increasing price of gold has started a depression gold rush that has taken many thousands of men and women into regions where placer mining once was profitable, with the idea of making at least a living by mining gold with pick, shovel and gold pan in the old-fashioned way.

Estimates of the gold that has been mined by these amateurs vary widely. It is said that 12,000 of them who worked an average of three months in northern California took about \$500,000 worth of gold from the old placers—an average of a little less than fifty cents a day. But, no matter how low their daily earnings may have been, they have added something to the gold stock of the nation that will be guarded in the new Treasury vaults in Washington.

It seems a long way from some lonely placer deposit in the wilderness to the Treasury's concrete-and-steel vaults in Washington. But gold is where you find it—and it is gold that is the foundation and safeguard of our monetary system. That's why men sweat and suffer to win it from nature, that's why the Government takes such elaborate precautions to guard its store.

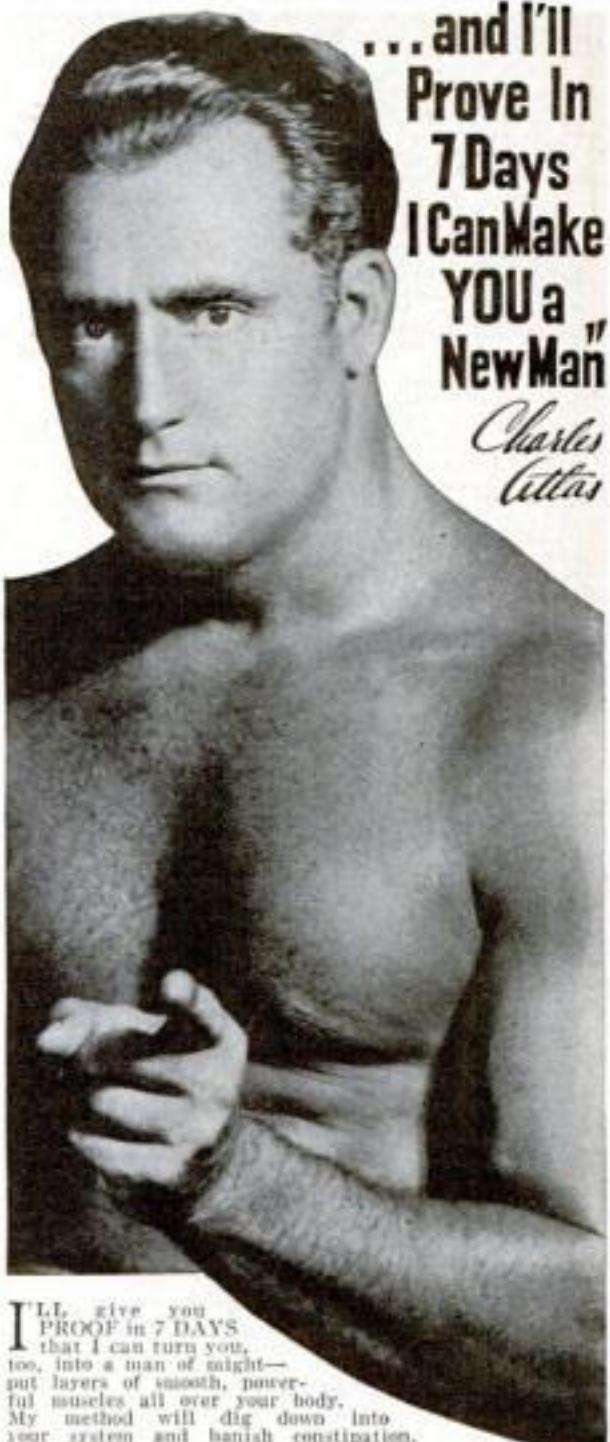
## USE COPPER TREATMENT TO CURE SICK TREES

TREE diseases are cured by copper according to a report made at a meeting of the Botanical Society of America by Prof. W. E. Burge, of the University of Illinois. In some cases of anemia in animals and men, copper has been found beneficial. In the case of trees, Prof. Burge found, it may be equally effective in overcoming a lack of chlorophyll, the green coloring matter, in the leaves. Tests were made on orange trees with unhealthy leaves. Doses of copper sulphate were scattered on the soil around the base of the trunk. Four months later, the trees had glossy green leaves. Other trees not treated with copper retained yellow leaves.

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## NATURE OF COPPER IS PROVED IN YOUR LABORATORY

(Continued from page 57)

flame; the metal being volatile only at higher temperatures. However, if chlorine gas is fed into the air port of the gas burner while the copper is held in the flame, the blue color will be seen at once. You can make the chlorine gas for this experiment by adding a bit of acid to some bleaching powder contained in a flask connected to the gas burner air port with a rubber tube. Only a small quantity of the gas will be necessary.

The bluish color formed when copper compounds are placed in an open flame is attributed to the decomposition of the chemical into its component parts and their immediate reunion. It is the reuniting of the parts that gives the color. To demonstrate this, place the bowl of a bubble pipe in the bluish-green flame colored by copper chloride. The clay surface will become coated with metallic copper that can be polished and buffed to give the familiar reddish tint of the metal.

**B**ESESIDES being colored, the flame produced by copper chemicals will conduct electricity. To prove this you will need the simple piece of homemade apparatus shown in the photo. It consists of two strips of copper tacked to a wooden handle and connected in series with a small neon lamp to the house lighting circuit. Pressing the two copper strips together should light the lamp.

For the experiment, first insert the strips in the open flame of your gas burner. The lamp will glow feebly. Then, place a small bit of copper chloride on the upper face of the bottom strip and again hold both strips in the flame. As the copper chemical decomposes and the flame takes on its characteristic color, the lamp will glow brighter. The colored flame bridging the space between the two strips will have increased the conductivity of the gap to allow more electricity to pass through the lamp.

Copper compounds also present vivid colors when placed in solution. Crystal chloride, for instance, when dropped into a tumbler of water soon will produce a strong solution of copper chloride at the bottom of the container. At first, the strong solution will be a deep green, but as it is stirred, the solution will be diluted with the remainder of the water and change to a pleasing blue. Another common colored copper compound solution is copper sulphate.

## TESTS SHOW ACQUIRED TRAITS ARE INHERITED

Is ABILITY inherited? Are sons of able fathers able because of association with them or because they inherit their qualities? White rats dropped into a tank of water have given the answer, according to Prof. William McDougall, of Duke University, Durham, N. C. The tank had two points of escape, consisting of gangways, one brightly lighted, but electrified, the other dimly lighted but unelectrified. The shocks they received at the brightly lighted runway taught the rats to avoid it. Successive generations of rats were trained in this way to avoid the electrified path of escape and the errors made by each generation were recorded. The average number of errors made on the first trial by the twenty-third generation was less than half that made by the thirteenth. Control rats of different stocks, but untrained, made far more errors than the animals whose parents had learned which gangway to use. Thus according to the scientist, ability appears to be handed on, from generation to generation as an hereditary quality and not to result entirely from association with those who are superior.

## FACES REMODELED BY PLASTIC SURGERY

(Continued from page 26)

Occasionally disease causes a nose virtually to sink into the face. Here the plastic surgeon faces one of his most interesting tasks, reconstruction of an entire nose. But with a knowledge of art and mechanics to supplement his surgical skill, he quickly builds up the member. Not only is a plaster cast made, but also a mask from liquid glue is fashioned. These masks may be cut or sewn into permanent life-size shapes.

**O**N THE forehead of the rubberlike mask, the surgeon first traces the area from which a flap is to be brought down to fashion the new nose. It was Dr. Blair who developed the "delayed flap" idea. That is, the flap is cut, then resown in place. Three weeks later, having developed a new blood supply and hardness, it is transplanted and grows readily. Finally the nostrils are lined.

Endotracheal anesthesia and the introduction of new anesthetic gases, such as ethylene in combination with oxygen, facilitates the plastic surgeon's work on the face. Gone in many cases are the ether cone and the gas mask during the operative procedure. With the new, specialized anesthesia, after the patient has been put to sleep by gas, a tube is inserted into his trachea and he breathes and rebreathes the gas from a collapsible lung. For the first time, medical science has achieved closed anesthesia. The gas passes back and forth through a soda-lime cannister which warms and dries it, while the addition of oxygen combats the carbon dioxide thrown off by the lungs.

Drs. Gordon New and Fred Fagi at the Mayo clinic in Rochester, Minn. removed a cancer from a patient's larynx and jaw, cutting away not only the growth but also a generous section of adjacent healthy flesh, then covered the deficiency with grafts.

One surgeon in the East gave a workman a new thumb by taking a section of the tibia, or shin bone, and a tube flap from the abdomen and grafting them onto the injured hand. By two delicate operations the surgeon first attached the tube to the hand, and a few weeks later inserted the bone into the tube and attached it to the metacarpal bone.

In New York, Dr. J. Eastman Sheehan developed a method for grafting new nails on fingers from which the nails have been lost. Dr. Sheehan takes the middle third from a good nail on the opposite hand and plants it on the ailing finger. Soon the transplanted section grows to full size, while the donor hand regrows the old nail from each side.

Dr. Clarence Straatsma of New York found that skin from which the top has been removed can be "planted" beneath sunken areas on the body or face. More than one nose has been built up by this method, with the result that the patients lost the inferiority complex which had been caused by an unsightly deformity.

Plastic surgery has its roots in antiquity. It is, in fact, one of the oldest forms of surgery. Twenty-five centuries ago the Tile Makers' caste in India developed a method for making new noses. In the sixteenth century the Italians found (Continued on page 117)

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## FACES REMODELED BY PLASTIC SURGERY

(Continued from page 116)

a way to make a total nose, without anesthesia, by taking a flap from the arm and sewing it to the face. Tagliacozzi in 1597 wrote the first text on plastic surgery, but it interested no one to the point of advancing the art which declined until 1812, when a writer revived the Hindoo method in the Gentleman's Magazine, London.

In 1860, Riverdin evolved a way of cutting tiny pieces of skin, laying them on areas needing treating, and hoping they would grow. Riverdin and his contemporaries knew large grafts would not grow, but that sometimes the smaller thin pieces would. Not until Dr. Smith's application of pressure did large grafts become really successful.

**SENSATIONAL** as have been the results, grafts from one person to another seldom are successful, while those from animal to human, once proposed as a practical expedient, never "take." Yet a graft of any thickness may be transplanted on the same body. Experienced surgeons have found that a thin slice may be removed safely from the same area every month. Full-thickness skin may be removed, as surgeons repeatedly demonstrated, by following two simple precautions. As an example, one recently took a section twelve inches square from a patient's stomach to cover an old burn on his back. Then he shaved off a piece of equal size, but hardly thicker than a sheet of paper, from the leg to cover the scar on the stomach. The deeply cut area, they have learned, requires no protection other than that it be not left raw.

These delicate operations are performed in about the same manner and with approximately the same instruments as are used by the general surgeon. Skin graft knives are long, flat and razorlike. Various ingenious devices are used to support noses after operations. Special chisels are used to remove rib cartilage and level bony humps. Some of the most important devices are the masks, mirrors, and drawings by means of which the patient satisfies himself that his future appearance will please his friends and himself.

Although as old as medicine itself, plastic surgery is considered a new medical specialty. Two years ago the Society of Plastic and Reconstructive Surgery of New York City was formed, drawing its membership from all over the world. Dr. Jacques W. Maliniak is president. Today fewer than fifty skilled surgeons are members. These men are trying to remove plastic surgery from the hands of quacks and charlatans, to take it from the beauty-parlor classification. They offer the public only one bit of counsel: "When contemplating featural or reconstructive surgery, consult your local medical association for advice in selecting your surgeon."

## BALANCED DIET HELPS BODY FIGHT GERMS

IF YOU eat a diet consisting of 140 grams of fat, twenty-five of protein and fifteen of carbohydrate, you can increase the germ-killing ability of your body, researches at the Mayo Clinic, Rochester, Minn., have just discovered. Dr. A. E. Osterberg, of the clinic, reported at a recent meeting of the American Chemical Society that such diet has been found to increase the production of ketones, or bacteria-destroying acids which are normally manufactured from the fat of the body in the process of digestion. During tests, the production of ketones was found with special paper that changed color when touched by the acids. The researches show the body produced the greatest amounts of ketones when the diet mentioned above was used.

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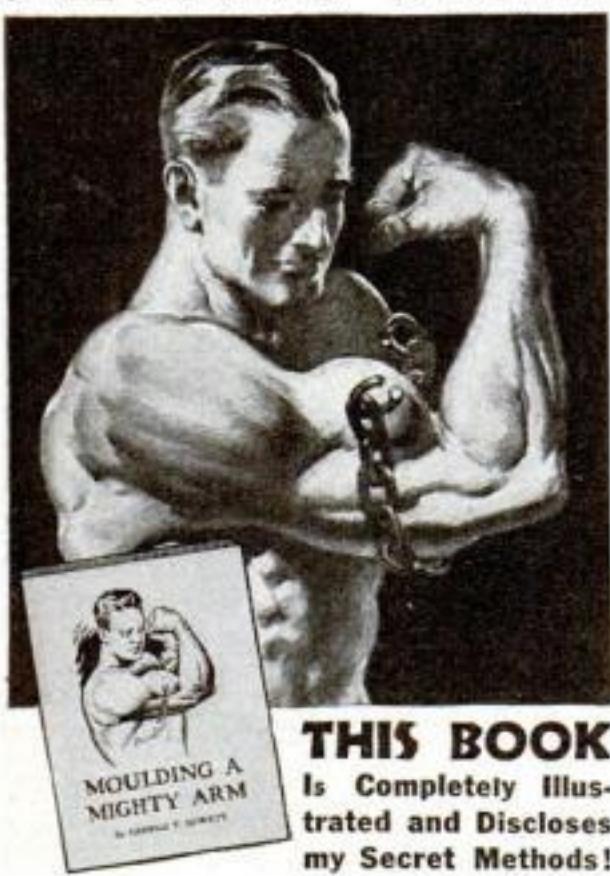
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(Continued from page 15)

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Including the mounting, with its massive fork and bearing ring, the moving parts of this biggest telescope will weigh nearly 500 tons. Yet clockwork, huge roller bearings, and powerful worm-gear drive make it easy to swing it across the whole span of the sky. By the mere pushing of electric buttons, the entire instrument may be turned around on its two axes with the smooth precision of the stars themselves.

A UNIQUE feature of the big mirror will be its relatively short focal length. In the 100-inch mirror of Mount Wilson, the rays reflected from a star are concentrated near the top of the tube at a point five times the diameter of the mirror. In the 200-inch mirror, however, the rays will be concentrated at a point only three and three tenths times the diameter. This will make each point of light more than twice as intense as it would be if it traveled the longer distance. As a result, the new mirror will be fully ten times as powerful as the 100-inch mirror.

Although four or five years of hard work remain to be done before this great telescope can scan the heavens, astronomers already are asking: What will it see? What will it discover in space? What will it add to man's knowledge of the universe?

The rapidly expanding scope of astrophysical research, concerning itself with physical makeup of heavenly bodies, has revolutionized the use of large telescopes and makes such questions difficult to answer. No longer a mere stargazer, the modern astronomer is a worker in vast stellar laboratories where problems of chemistry and physics, far greater than are found in our laboratories on earth, are waiting to be solved. Pointing his telescope toward the Great Nebula in Orion, he finds matter more diffuse than it is in the rarest vacuum on earth. Swinging it toward the dwarf companion star of Sirius, he conjures with masses weighing a ton to the cubic inch. Investigation of the stars has become today as necessary to the chemist and the physicist as to the student of stellar evolution and the structure of the universe.

By analyzing the spectra of hundreds of brighter stars, astronomers have revealed the unity of substance of earthly and celestial bodies, and have traced the evolution of stars and star clusters. These studies have served as a guide to the real nature of matter, assisting the basic sciences of physics and chemistry. The first ionized particles, bits of matter carrying charges of electricity, were found in the sun and stars. The prediction that, under certain conditions, matter may be changed into radiation, is proved by stellar observation.

ALL such investigations, and more, will be part of the job of the new telescope. For the nearer stars, the heat and light will be stronger than hitherto obtainable; on the other hand, thousands of stars previously too faint to study will sweep into the laboratory of the stellar analyst.

Perhaps its greatest advantages, however, will be its immense gain in penetrating power and its ability to record the faint spiral nebulae, or island universes, in remote space. According to Dr. Edwin P. Hubble, astronomer at Mount Wilson Observatory, at least 75,000,000 of these nebulae, each made up of millions of stars, may be noted with the present instrument used on the California mountain top. The new giant is expected to reveal from four to six times as many. By

making possible a more nearly accurate analysis of the light of these clusters, their relative speeds may be determined and valuable clues obtained with which to investigate the theory that the universe is expanding.

ALTHOUGH it would be possible to magnify the light images of the 200-inch telescope more than the images collected by any other telescope in the world, high magnification will seldom, if ever, be used. Its great value will lie in the amount of light it can gather from the farthest frontiers of space. With ten times the light-collecting power of the 100-inch telescope, stars may be weighed, analyzed, measured, with an accuracy never attained before. Clear snapshots of the moon can be made in a fraction of a second. Nebulae hundreds of millions of light years beyond the grasp of smaller telescopes may be caught for the first time on a photographic plate. A light year is the distance a beam of light, traveling 186,000 miles a second, would go in one year.

The surging of the earth's atmosphere is one of the obstacles the large telescopes have to meet. Images that are steady and bright in the eyepiece of a small instrument are often blurred and indistinct when viewed in a mirror even sixty inches across. Clear, cold winter nights, when the stars seem brighter than usual, are the worst offenders. Excessive twinkling of the stars means irregular bending of the light rays as they come through layers of air at different temperatures, and this causes confused images in the telescope.

Because of this turbulent ocean of air, which envelopes the earth and obscures our vision of celestial objects in direct proportion to the power of our telescopic eyes, it was considered a gamble to advance even from a sixty-inch to a 100-inch telescope. Years of use of the latter instrument, however, have proved that the earlier fears were unwarranted and that the gain in results over the smaller telescopes have corresponded directly with the increased size.

ATTACHED to the upper end of the 100-inch telescope is the long beam of the Michelson stellar interferometer, which measures the size of stars. With it, Dr. Francis G. Pease, the astronomer who is in charge of designing equipment at Mount Wilson, has measured the diameters of a large group of heavenly bodies. When astronomers feared the effect of wavering air upon star images reflected from a mirror seventeen feet across, Pease put the interferometer to an ingenious use. Separating the two outer mirrors as far as possible, he united in a single image beams of light reaching the earth by paths twenty feet apart. Comparing these images with images observed when the mirrors were 100 inches apart, he concluded that an increase of mirror diameter to at least twenty feet was a perfectly safe undertaking.

According to Dr. George Ellery Hale, founder and present Honorary Director of the Mount Wilson Observatory, the 100-inch telescope has already added immeasurably to our knowledge of the heavens. Among other things, it has given us a new means of determining stellar distances, a greatly clarified conception of the structure and scale of our Milky Way, the first data on the diameter of stars, new light upon the constitution of matter, new support for the Einstein theory of relativity, and new and surprising researches in the realm beyond the boundaries reached by former instruments. This dean of American astronomy is convinced of the great need for the 200-inch telescope to carry farther into space the work of exploration.

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## ELECTRIC CURRENT DETERMINES SEX

(Continued from page 58)

keeping careful record of which was used, could he put his theory to the test.

Six weeks later, the broods began to arrive. The first contained six baby rabbits. Every one was a female. The mother had been fertilized from the tube containing the positive pole. The second brood contained five. All were male except one. Their mother had been fertilized from the tube containing the negative pole. A third brood had been produced by mixing the cells taken from the two tubes. A litter of four resulted. Two were male, two female. Thus, it appeared that the negative pole attracted the male cells, the positive pole the female cells.

BUT Koltzoff, who has been director of the Institute for Experimental Biology in Moscow for fifteen years, was not satisfied. He made arrangements with scientists in another laboratory to fertilize a large number of doe rabbits with material he would supply. The animals were divided into two groups, one half being fertilized with the male cells, the other half with the female cells. The workers, who kept careful records of the results, were not told which cells were which. The figures substantiated the hypothesis.

The probable explanation of why 100 per cent results were not obtained is given by the microscope. It shows that sometimes the spermatozoa have looped or twisted tails. In the turbulent process of separation in the U-tube, such cells might have become entangled with their opposites and have been carried to the wrong electrical pole.

That the Koltzoff methods can be applied to larger animals as well has been indicated by other tests. The fertilizing cells of the bull and the stallion have been divided as easily as those of the rabbit. At government farms, where more than 2,000,000 animals have been artificially fertilized in the last few years, the new methods of controlling sex are being tried out. In natural breeding, it is recognized that there is always a wasteful surplus of males. By governing sex so that females form ninety percent or more, the number of livestock can be rapidly increased.

Whether the sex of poultry can be determined in a like manner remains to be seen. It has been discovered recently that, contrary to the rule among mammals, the egg cell and not the sperm cell determines the sex among birds. Tests are now under way at the Moscow laboratory to discover if the electrical methods which have proved successful with the male cells of the mammal will also be effective with the birds.

FOUR years ago, Koltzoff and a fellow biologist, Dr. A. A. Zamkoff, discovered gravidan, an extract from the secretions of expectant mothers. It has demonstrated curative powers in a number of diseases including a certain form of insanity known as schizophrenia. It has also shown value in rejuvenation. Both American and German scientists have adapted its use and in Russia its discovery has resulted in the establishment of a special Institute of Uro-Therapy.

Born in 1872, Koltzoff was educated at the Moscow University and spent a number of years working in laboratories in Germany, France, and Italy. His success in preserving pure strains in silkworms by the self-fertilization of the egg through the use of iodine attracted wide attention and his method was later used commercially. He has written many books on genetics and is recognized as one of the outstanding biologists of Europe. Consequently, the report that his U-tube and electrical wires have found the answer to the age-old riddle of determining sex is attracting wide interest among scientists.

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# Freak Effects of Sound Revealed by New Tests

(Continued from page 17)

chemicals it contains, how much of each is present, and whether the compound is adulterated with any impurity.

Another way in which sound waves have been put to work was demonstrated by Dr. Leslie A. Chambers and Prof. Newton Gaines at the Texas Christian University, Fort Worth. By running milk through a funnel containing a nickel tube which gave off a constant high-pitched note, they were able to kill from eighty to 100 percent of all bacteria. Even microbes which had not been harmed by pasteurization were killed by the intense sound waves coming from the singing tube.

**D**R. CHAMBERS, together with Dr. Earl W. Flosdorff, of the University of Pennsylvania, demonstrated even more astonishing feats with sound waves at last year's meeting of the American Association for the Advancement of Science. They soft boiled an egg without raising its temperature. The sharp sound produced chemical reactions, coagulating the protein. Using the penetrating waves of a submarine horn, such as is used in signaling under water, they generated acetylene from vegetable oils, extracted grape sugar from cane sugar, and converted ethyl acetate into acetic acid. The hypothesis advanced to account for these feats of apparent magic is that the sound waves, in some mysterious way, accelerate the molecules in the substances treated and thus produce spontaneous chemical reactions.

That sound waves are capable of destroying solid structures is an often-advanced theory. Although it would require 30,000,000 cornetists blowing their hardest to produce one horsepower of sound, one scientist recently pointed out that you could make the Empire State Building sway and eventually fall if you could produce the right note and hold it long enough with sufficient volume. The Biblical story of the walls of Jericho falling at the sound of Gideon's trumpets, has frequently been explained in this manner.

A strange modern example of the kind occurred not long ago in an eastern factory.

Sucking air from the interior, a large fan drove it up a brick ventilating stack as part of the air-conditioning apparatus. As soon as the fan speeded up, the chimney swayed and quivered until bricks began to fall. Engineers thought the electric motor was to blame. They anchored it to a solid concrete base. The vibrations continued just the same. Finally, the owners of the building called in an acoustical expert. He discovered that as the fan revolved, each blade sent a puff of air up the chimney. At top speed, the puffs formed a regular beat, like sound waves, and the sympathetic pulsation of the stack became stronger and stronger until it threatened to fly to pieces. The remedy was simple. By gearing down the fan a trifle, the rate of the beats was altered and the trouble vanished.

Another bit of industrial detective work in which a puzzle was solved by a knowledge of sound took place in Detroit, Mich. One of the big automobile factories was putting out a new car. At a certain speed, it developed a bad humming sound. The engineers suspected the gears, but when they checked them over, they could find nothing wrong. One member of the engineering staff had taken up acoustics as a hobby. He noted that the hum had a definite pitch, F sharp below middle C, which corresponds to about 180 vibrations a second. He also found that at the speed when the hum appeared, the rear wheels were making exactly two revolutions a second. Counting the non-skid projections on the tires, he discovered there were ninety knobs on each. Revolving twice a second, they had produced the 180 vibrations which formed the hum. By substituting tires with a different tread, the engineer eliminated the trouble.

Of all the tasks which such experts have been called upon to accomplish in recent years, undoubtedly the most difficult was the designing of the broadcasting studios at Radio City, New York. Rooms within rooms were mounted on springs and rubber cushions to cut off all sound-carrying vibrations. Ventilating ducts were equipped with mats of fire-proofed seaweed to filter out noise. Mineral wool and porous tiles were employed for lining the studios and absorbing sound.

Setting echoes to work has just resulted in a new sonic altimeter for showing airmen their height above the ground, as the sonic depth finder shows sailors their distance from the floor of the sea. Dr. Leo P. Delsasso, University of California physicist, is the inventor of the instrument. He recently demonstrated it near Los Angeles. Cruising 700 feet in the air in a blimp, he pressed the button of an electric horn. Its high-pitched blast cut through the roar of the motors. An instant later, the echo, rebounding from the earth, was caught by a selective microphone, tuned to catch sounds of only one pitch. The apparatus quickly translated the elapsed time into feet, thus indicating the height of the craft above the ground.

**C**HECKED by other instruments, the reading was found to be accurate to within one foot in 700. Other tests indicated that the echoes were picked up in rain and fog almost as easily as in fair weather. Thus the

## Snakelike Movie Camera Takes Odd Close-ups



**UNUSUAL** close-ups are possible with this camera which is mounted on a coil spring. As a result, the lens can be pointed in any direction without moving stand's position

new instrument, which shows altitude over the ground below—and not, as is the case with the ordinary altimeter, above the starting point—promises to be of especial value in blind flying. The main problem to be overcome is the muffling effect of trees and forests which tend to prevent echoes.

Looking ahead to high-speed planes of the future, there is the curious possibility that such altimeters will be made obsolete because planes will travel faster than sound!

Racing machines have already attained 420 miles an hour. Add 300 more and they will reach 720 miles an hour, the speed of sound. Already, one of the engineers at Langley

Field, Va., has worked out the design for a streamlined monoplane which can travel seventy-two percent as fast as sound with an existing type of motor for the power plant.

A second apparatus which employs echoing sound waves as an aid to navigation is a sonic locator demonstrated last summer by Chester W. Rice, General Electric engineer. Picking up echoes from boats, buoys, and docks, it enabled him to guide a seventeen-ton motorboat through a dense fog on Long Island Sound. The device revealed the presence of steamers half a mile away and detected small rowboats 800 feet ahead in the mist. Mounted on a skeleton framework on the upper deck of the boat is a triangle of megaphones. One gives out a shrill whistle, directing it straight ahead. Objects in the way reflect back the sound, the lapse of time and the direction from which the echo comes indicating the distance and position of the point of danger.

**T**HE loudest sound ever heard by man is believed to have been the eruption of Krakatoa, a volcano in the Dutch East Indies. Exploding like a titanic bomb in 1883, it struck the atmosphere such a blow that air waves affected barographs on three successive journeys around the globe. Recently, science has perfected sound detectors for registering the loudness of common noises in units called decibels. These tests showed the howl of an airplane propeller makes more noise than a boiler factory.

Using sensitive microphones and amplifiers, Raymond L. Ditmars, curator of mammals and reptiles at the New York zoological park, not long ago listened in on the noise of an anthill. His delicate apparatus enabled him to catch the roar of traffic in the main streets of the insect city.

Another experiment, which only deepens a mystery of sound, took place in the snake house of the same zoo. In an effort to study the effect of music upon serpents, Ditmars had a sitar, a guitarlike instrument from India, played behind the cage of a thirteen-foot King Cobra. The great snake reared into the air at the first sound of the instrument. In a few minutes, at a certain note or overtone, it swayed slightly, a peculiar shudder ran along its neck, and it fell to the floor. It lay as though dead for several seconds, then reared into the air again.

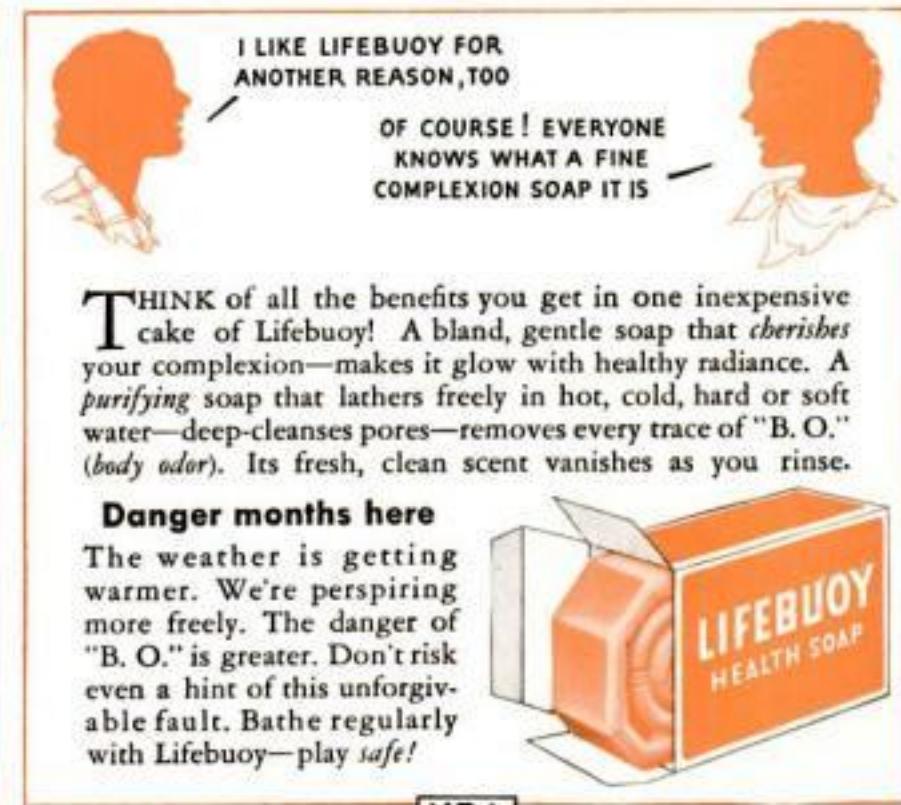
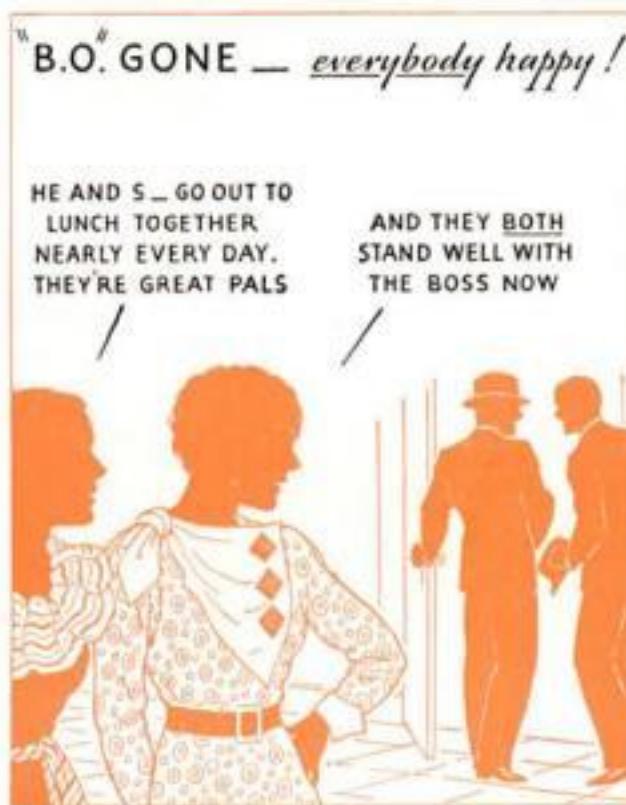
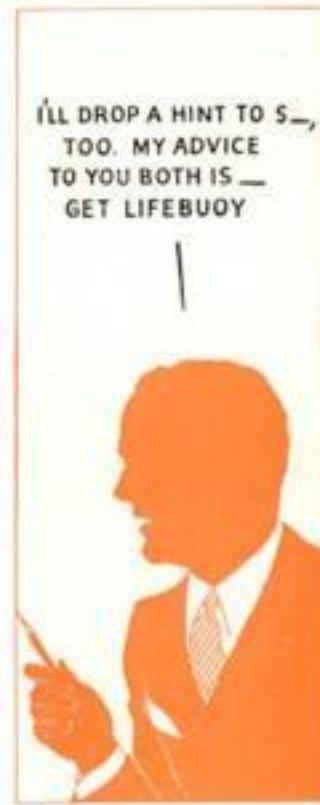
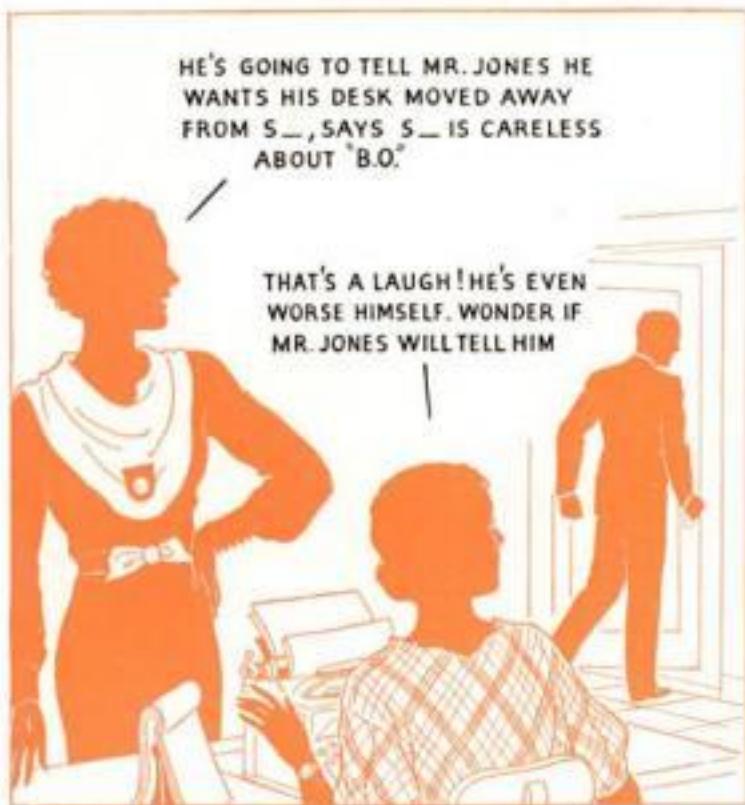
The effect of soothing music and of harsh noises upon human emotions is well known. Recent researches have disclosed just what happens in our brain and stomachs when a loud or harsh noise strikes our ears. In one test, instruments showed that when a paper bag is burst near the ear of a subject, the pressure in his brain rises to four times normal. In another experiment, the natural rhythmic action of the stomach was found to be halted one third by any harsh noise.

That sounds which we never hear may also have an injurious effect upon our systems has been demonstrated in a remarkable experiment. Using a powerful alternating current, research workers made a quartz plate, at the bottom of a beaker filled with water, pulsate faster and faster until it produced waves of 600,000 vibrations a second.

Then fantastic things began to happen. Weeds floating in the water were torn to pieces. Fish and frogs were struck by a mysterious blight and died as they tried to swim. Men who thrust forefingers into the water felt an acute pain shoot up their hands. When one end of a long glass thread was held between the fingers and the other end placed in the water, the skin was seared as though the glass had been a red-hot wire!

In the realm of sound, there are many such mysteries. Solving them is an activity attracting an increasing amount of attention.

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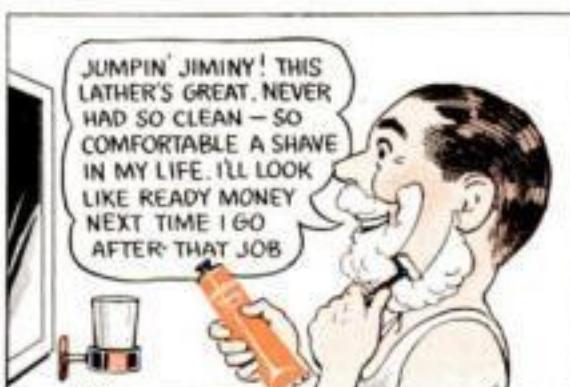
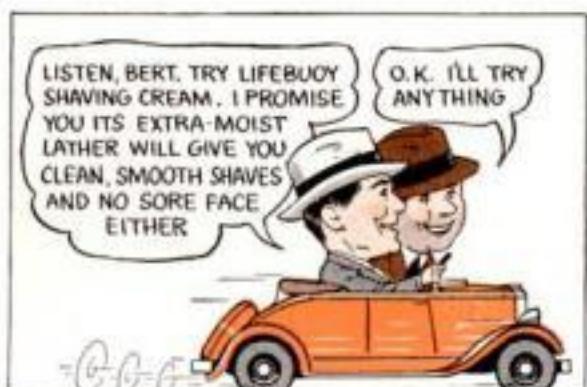
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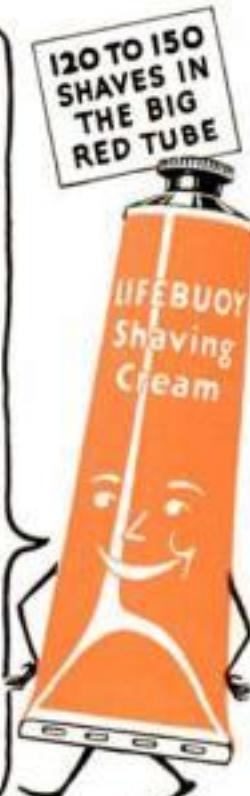
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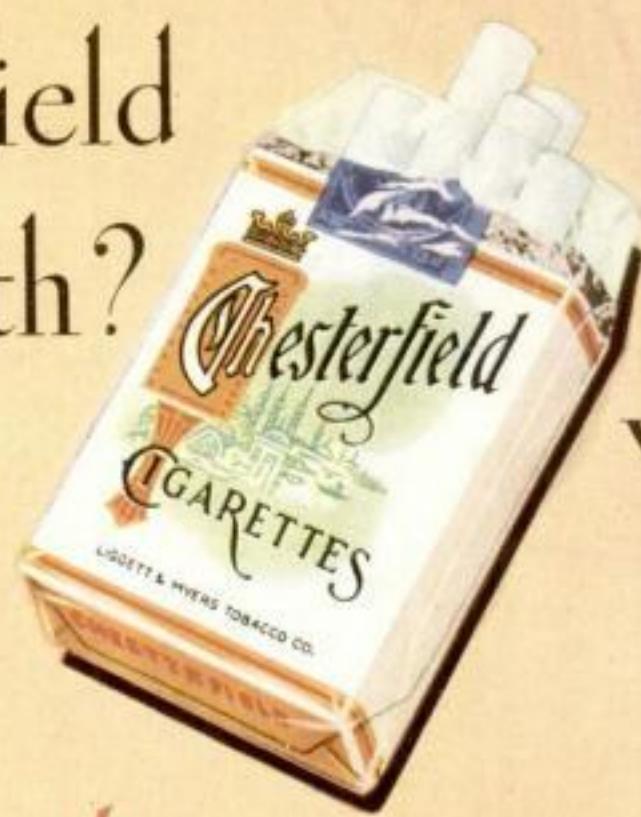
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